

**West Virginia
University
Bulletin**

**Graduate School
Catalog 1969/70**



YEAR 1969

JANUARY							FEBRUARY							MARCH							APRIL						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
5	6	7	8	9	10	11	2	3	4	5	6	7	8	2	3	4	5	6	7	8	6	7	8	9	10	11	12
12	13	14	15	16	17	18	9	10	11	12	13	14	15	9	10	11	12	13	14	15	13	14	15	16	17	18	19
19	20	21	22	23	24	25	16	17	18	19	20	21	22	16	17	18	19	20	21	22	20	21	22	23	24	25	26
26	27	28	29	30	31		23	24	25	26	27	28	30	23	24	25	26	27	28	29	27	28	29	30			
MAY							JUNE							JULY							AUGUST						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
4	5	6	7	8	9	10	1	2	3	4	5	6	7	6	7	8	9	10	11	12	3	4	5	6	7	8	9
11	12	13	14	15	16	17	8	9	10	11	12	13	14	13	14	15	16	17	18	19	10	11	12	13	14	15	16
18	19	20	21	22	23	24	15	16	17	18	19	20	21	20	21	22	23	24	25	26	17	18	19	20	21	22	23
25	26	27	28	29	30	31	22	23	24	25	26	27	28	27	28	29	30	31			24	25	26	27	28	29	30
SEPTEMBER							OCTOBER							NOVEMBER							DECEMBER						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
7	8	9	10	11	12	13	5	6	7	8	9	10	11	2	3	4	5	6	7	8	7	8	9	10	11	12	13
14	15	16	17	18	19	20	12	13	14	15	16	17	18	9	10	11	12	13	14	15	14	15	16	17	18	19	20
21	22	23	24	25	26	27	19	20	21	22	23	24	25	16	17	18	19	20	21	22	21	22	23	24	25	26	27
28	29	30					26	27	28	29	30	31		23	24	25	26	27	28	29	28	29	30	31			

YEAR 1970

JANUARY							FEBRUARY							MARCH							APRIL						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
4	5	6	7	8	9	10	1	2	3	4	5	6	7	1	2	3	4	5	6	7	5	6	7	8	9	10	11
11	12	13	14	15	16	17	8	9	10	11	12	13	14	15	16	17	18	19	20	21	12	13	14	15	16	17	18
18	19	20	21	22	23	24	15	16	17	18	19	20	21	22	23	24	25	26	27	28	19	20	21	22	23	24	25
25	26	27	28	29	30	31	22	23	24	25	26	27	28	29	30	31					26	27	28	29	30		
MAY							JUNE							JULY							AUGUST						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
3	4	5	6	7	8	9	7	8	9	10	11	12	13	5	6	7	8	9	10	11	2	3	4	5	6	7	8
10	11	12	13	14	15	16	14	15	16	17	18	19	20	12	13	14	15	16	17	18	9	10	11	12	13	14	15
17	18	19	20	21	22	23	21	22	23	24	25	26	27	19	20	21	22	23	24	25	16	17	18	19	20	21	22
24	25	26	27	28	29	30	28	29	30					26	27	28	29	30	31		23	24	25	26	27	28	29
31																					30	31					
SEPTEMBER							OCTOBER							NOVEMBER							DECEMBER						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
6	7	8	9	10	11	12	4	5	6	7	8	9	10	1	2	3	4	5	6	7	6	7	8	9	10	11	12
13	14	15	16	17	18	19	11	12	13	14	15	16	17	8	9	10	11	12	13	14	13	14	15	16	17	18	19
20	21	22	23	24	25	26	18	19	20	21	22	23	24	22	23	24	25	26	27	28	20	21	22	23	24	25	26
27	28	29	30				25	26	27	28	29	30	31	29	30						27	28	29	30	31		

The Graduate School

Announcements 1969 / 70

West Virginia University Bulletin

West Virginia University MORGANTOWN

ESTABLISHED FEBRUARY 7, 1867

The Board of Governors

	TERM EXPIRES
K. DOUGLAS BOWERS, <i>President</i> , Beckley	1971
MRS. GILBERT S. BACHMANN, <i>Vice President</i> , Wheeling	1973
RALPH J. BEAN, Moorefield	1970
ALBERT B. C. BRAY, JR., Logan	1972
PAT R. HAMILTON, Oak Hill	1977
THOMAS L. HARRIS, Parkersburg	1974
FORREST H. KIRKPATRICK, Wheeling	1975
PAUL B. MARTIN, Martinsburg	1976
CHARLES C. WISE, JR., Charleston	1969
JAMES G. HARLOW, <i>Chief Executive Officer</i> , Morgantown	

The Board of Governors has charge of the educational, administrative, financial and business affairs of the University, Potomac State College, Parkersburg Center, and the Kanawha Valley Graduate Center.

It is the policy of West Virginia University to provide equal opportunities to all prospective and current members of the student body, faculty, and staff solely on the basis of individual qualifications and merit without regard to race, religion, sex, age, or national origin.

The University also neither affiliates with nor grants recognition to any individual, group, or organization having policies that discriminate on the basis of race, religion, sex, age, or national origin.

The Board of Governors of West Virginia University reserves the right to change any provision or requirement stated in this publication within the student's term of residence. It reserves the right also at any time to ask a student to withdraw when such action seems to be in the best interest of the University.

West Virginia University Bulletin/Series 69, No. 8-12, February, 1969

Issued Monday, Wednesday, and Friday

Second class postage paid at Morgantown, West Virginia 26506

Contents

UNIVERSITY CALENDAR	4
ADMINISTRATIVE OFFICERS	5
PART I—GENERAL INFORMATION	8
PART II—ACADEMIC INFORMATION AND REGULATIONS	23
PART III—FINANCIAL INFORMATION AND REGULATIONS	34
PART IV—COURSES OF STUDY	39
Agriculture and Forestry	39
Arts and Sciences	56
Commerce	105
Creative Arts Center (Music, Art, Drama)	112
Dentistry (Orthodontics)	219
Engineering and Mines	124
Forestry	52
Human Resources and Education (Human Resources Research Institute, Clinical Studies, Education, Family Resources, Social Work)	162
Industrial Relations	206
Institute of Biological Sciences	207
Journalism	210
Medical Center	213
Medical Technology	194
Mines	158
Pharmacy	220
Physical Education	223
PART V—THE GRADUATE FACULTY	230
INDEX	251

University Calendar

1969

May 17, Saturday	Alumni Day
May 18, Sunday	Commencement Exercises
June 16, Monday	Registration for Summer Session
June 17, Tuesday	First Classes, First Summer Term
July 4, Friday	Independence Day Recess
July 9, Wednesday	English Proficiency Examination
July 18, Friday	Close of First Summer Term
July 21, Monday	First Classes, Second Summer Term
August 19, Tuesday	Close of Second Summer Term
August 25, Monday to August 27, Wednesday, incl.	Freshman Orientation
August 26, Tuesday	General Registration, First Semester
August 27, Wednesday	General and Freshman Registration
August 28, Thursday	First Classes, First Semester
September 1, Monday	Labor Day Recess
September 18, Thursday	English Proficiency Examination
October 14, Tuesday	Faculty Assembly Meeting
October 21, Tuesday	Mid-Semester
October 27, Monday	Mid-Semester Reports Due
October 28, Tuesday	Graduate Faculty Meeting
November 27, Thursday, to November 30, Sunday, incl.	Thanksgiving Recess
December 12, Friday	Last Classes, First Semester
December 15, Monday to December 20, Saturday, incl.	Final Examinations, First Semester
December 21, Sunday to January 5, Monday, incl.	Christmas Recess

1970

January 6 and 7, Tuesday and Wednesday	General Registration, Second Semester
January 8, Thursday	First Classes, Second Semester
February 5, Thursday	English Proficiency Examination
February 7, Saturday	West Virginia University Day
March 6, Friday	Mid-Semester
March 7, Saturday to March 15, Sunday, incl.	Spring Recess
March 16, Monday	Mid-Semester Reports Due
April 14, Tuesday	Faculty Assembly Meeting
May 1, Friday	Last Classes, Second Semester
May 4, Monday to May 9, Saturday, incl.	Final Examinations, Second Semester
May 11, Monday	Grade Reports for Graduating Seniors and Graduate Students Due in Deans' Offices
May 12, Tuesday	Deans' Reports of Graduates Due in Registrar's Office
May 16, Saturday	Alumni Day
May 17, Sunday	Commencement

The Graduate School

ADMINISTRATIVE OFFICERS

GENERAL

- President*, JAMES C. HARLOW, A.B., M.S., Ph.D., LL.D., (1967).
Vice-President—Administration and Finance, HARRY B. HEFLIN, A.B., A.M., Ph.D., LL.D., (1964).
Vice-President—Off-Campus Education, ERNEST J. NESIUS, B.S.A., M.S.A., Ph.D., (1968), 1960.
Vice-President—Planning, CLAUDE KELLEY, A.B., M.Ed.D., Ed.D., (1967).
Provost for Instruction, JAY BARTON, II, A.B., M.A., Ph.D., (1968), 1966.
Provost for Research and Graduate Studies, ROBERT F. MUNN, A.B., M.A., Ph.D., (1968), 1952.
Provost for Health Sciences, CHARLES E. ANDREWS, B.S., M.D., (1968), 1960.
Assistant to the President, HAROLD J. SHAMBERGER, A.B., M.P.A., (1960), 1949.
Assistant to the President and Secretary of the Board of Governors, LONDO H. BROWN, A.B., LL.B., (1967), 1950.
Assistant to the President for Grants and Contracts, GEORGE E. KIRK, B.S., M.B.A., (1968), 1964.
Dean of Student Educational Services, JOSEPH C. GLUCK, B.A., B.D., (1968), 1943.
Director of Admissions, EARL R. BOGGS, A.B., M.A., Ph.D., (1965), 1960.
Director of Libraries, ROBERT F. MUNN, A.B., M.A., Ph.D., (1957), 1952.
Comptroller, WILLIAM H. McMILLION, B.S., M.S., (1965), 1952.
Registrar, STANLEY R. HARRIS, A.B., M.S., (1963), 1953.
Director of University Hospital, EUGENE L. STAPLES, B.S., M.H.A., (1960).
Director of Alumni Affairs, DAVID W. JACOBS, A.B., (1938).
Director of Development, DONOVAN H. BOND, B.S.J., M.A., (1959), 1946.
Director of Intercollegiate Athletics, ROBERT N. BROWN, A.B., (1954), 1950.
Director of University Relations, HARRY W. ERNST, B.S., M.S., (1968).

COLLEGES AND SCHOOLS

- Agriculture and Forestry*, ROBERT S. DUNBAR, JR., Ph.D., *Dean*, (1964), 1952.
Agricultural Experiment Station, A. H. VANLANDINGHAM, Ph.D., *Director*, (1959), 1929.
Appalachian Center, RONALD L. STUMP, M.S., *Acting Dean; Acting Director, Co-operative Extension Service*, (1969), 1948.
Arts and Sciences, CARL M. FRASURE, Ph.D., *Dean*, (1961), 1929.
LLOYD R. GRIBBLE, Ph.D., Associate Dean, (1961), 1929.
Commerce, JACK T. TURNER, D.B.A., *Dean*, (1969).

NOTE: The date in parentheses indicates year of latest appointment. The second date indicates year of first appointment to a University position.

Creative Arts Center, RICHARD E. DUNCAN, Ph.D., *Dean and Director*, (1964), 1958.
 Dentistry, W. ROBERT BIDDINGTON, D.D.S., *Dean*, (1968), 1959.
 Engineering, CHESTER A. ARENTS, M.E., *Dean*, (1955).
 Engineering Experiment Station, JAMES H. SCHAUB, Ph.D., *Associate Director*, (1967), 1958.
 Graduate, JOHN C. LUDLUM, Ph.D., *Dean*, (1968), 1946.
 Human Resources and Education, STANLEY O. IKENBERRY, Ph.D., *Dean*, (1965), 1962.
 Journalism, QUINTUS C. WILSON, Ph.D., *Dean*, (1961).
 Law, PAUL L. SELBY, JR., LL.B., *Dean*, (1964).
 Medicine, CLARK K. SLEETH, M.D., *Dean*, (1961), 1935.
 Mines, CHARLES T. HOLLAND, M.S.E.M., *Dean*, (1961), 1930.
 Nursing, LORITA DUFFIELD JENAB, Ed.D., *Dean*, (1968).
 Pharmacy, RAPHAEL O. BACHMANN, Ph.D., *Dean*, (1961).
 Physical Education, C. PETER YOST, Ph.D., *Dean*, (1969), 1946.
 Kanawha Valley Graduate Center, ROMAN J. VERHAALLEN, Ph.D., *Dean*, (1967), 1964.
 Parkersburg Center, ROBERT H. STAUFFER, Ph.D., *Dean*, (1967), 1966.

HEADS OF OTHER ADMINISTRATIVE OFFICES

Biological Sciences, Institute of, VALENTIN ULRICH, Ph.D., *Director*, (1967), 1957.
 Book Store, RUTH E. ROBINSON, A.M., *Manager*, (1944), 1939.
 Business Research, Bureau of, JAMES H. THOMPSON, Ph.D., *Director*, (1958), 1948.
 Computer Center, PHILLIP D. STARK, M.S., *Acting Director*, (1968).
 Counseling Service, JAMES F. CARRUTH, Ph.D., *Director*, (1965), 1953.
 Dean of Women and Director of Residence Halls Programs, BETTY BOYD, A.B., (1965), 1948.
 Government Research, Bureau for, (Vacancy).
 Health Service, JOHN J. LAWLESS, Ph.D., M.D., *Director*, (1960), 1949.
 High School, University, E. GRANT NINE, M.S., *Principal*, (1960), 1956.
 Housing, ROBERT A. ROBARDS, B.S.B.A., *Director*, (1965), 1960.
 Residence Halls, AGNES B. HOVEE, M.A., *Associate Director of Housing*, (1956), 1950.
 International Programs, NEWTON M. BAUGHMAN, Ph.D., *Director*, (1968), 1949.
 Mountainlair, ROBERT F. MCWHORTER, M.S., *Director*, (1959).
 Nursing Services, AUDREY E. WINDEMUTH, M.N.A., *Director*, (1961), 1960.
 Personnel, S. THOMAS SERPENTO, M.A., *Director*, (1964), 1960.
 Physical Plant, VERGIL B. CLARK, M.S., *Director*, (1965).
 Placement Service, M. CORNELIA LADWIG, Ph.D., *Assistant Director, Student Educational Services*, (1965), 1949.
 Publications, JOHN LUCHOK, B.S.J., *Editor*, (1963), 1950.
 Radio, Television, and Motion Pictures, C. GREGORY VAN CAMP, M.S.J., *Director*, (1960).
 Regional Research Institute, WILLIAM H. MIERNYK, Ph.D., *Director*, (1965).

GRADUATE SCHOOL EXECUTIVE COMMITTEE

ROBERT F. MUNN, Ph.D., (ex officio), *Provost for Research and Graduate Studies*,
JOHN C. LUDLUM, Ph.D., (ex officio), *Dean, Chairman*.
HOWARD W. BUTLER, Ph.D., *Professor of Mechanical Engineering* (1969).
HOMER C. EVANS, Ph.D., *Professor of Agricultural Economics* (1970).
RUEL E. FOSTER, Ph.D., *Professor of English* (1971).
HUGH A. LINDSAY, Ph.D., *Professor of Physiology* (1969).
GEORGE E. SCHAFER, Ph.D., *Professor of Music* (1970).
GUY H. STEWART, Ph.D., *Professor of Journalism* (1971).

UNIVERSITY SENATE COMMITTEES, 1968-69

Constitutional Committees

EXECUTIVE: President J. G. HARLOW, *Chairman*; W. W. FLEMING, D. F. MILLER, J. NEWHOUSE, P. POPOVICH, R. D. SLONNEGER, C. P. YOST, and W. H. BAKER, *Secretary*.

MEMBERSHIP AND CONSTITUENCIES: E. H. TRYON, *Chairman*; H. D. BENNETT, R. W. LAIRD, E. O. ROBERTS, C. B. TAYLOR, and W. H. BAKER (ex officio).

Standing Committees

FACULTY WELFARE: A. F. WOJCIK, *Chairman*; J. B. HARLEY, H. N. KERR, W. D. LORENSSEN, G. E. TOBEN, F. E. WRIGHT II.

NEW COURSES AND COURSE CHANGES: P. POPOVICH, *Chairman*; J. BARTON, L. FISHMAN, E. K. INSKEEP, J. H. JOHNSTON, L. D. LUTTRELL, W. H. MARSHALL, M. O. MEITZEN, D. F. MILLER, E. M. STEEL, JR.; R. F. MUNN and J. C. LUDLUM, (ex officio).

RESEARCH, RESEARCH GRANTS, AND PUBLICATIONS: A. E. SINGER, *Chairman*; W. E. COLLINS, R. G. CORBETT, J. C. EAVES, J. B. FANUCCI, J. J. McPHILLIPS, T. J. SHEEHAN, and J. LUCHOK (ex officio).

STUDENT INSTRUCTION: H. E. KIDDER, *Chairman*; C. W. CONNELL, W. W. FRENCH, M. T. HEALD, J. L. HICKS, JR., R. H. NEFF, M. E. POOL, R. D. SNYDER, JAY BARTON II (ex officio), and President of the Student Body (ex officio).

TEACHER EVALUATION: J. L. McBEE, *Chairman*; B. H. BAILEY, ROBERT BRITT, J. F. CARRUTH, W. A. SACK, JOHN SEMON, JAY BARTON II (ex officio).

Part I / General Information

West Virginia University, founded February 7, 1867, combines in a single institution the functions of a state university and of a state land-grant university—functions commonly assigned to two or more institutions in other states. Hence, the range and variety of instructional, research, and services programs at West Virginia University is greater than that of most institutions its size. The *primary* mission of the University within the West Virginia system of higher education is to serve as the major center of professional and graduate training and research in the State. The rapid movement of the University in this direction is reflected in the fact that from 1955-56 to 1967-68, University undergraduate enrollment almost doubled while graduate and professional school enrollments more than tripled. In the same period, total University operating expenditures increased from \$10.7 million to \$49.7 million.

The University had its origin in the Morrill Act of July 2, 1862, and in an act of the 1863 State legislature accepting the provisions of that act.

On January 9, 1866, trustees of the Monongalia Academy in Morgantown offered the State all of its property, including the site of Woodburn Female Seminary on condition that the new institution be located there.

The offer was accepted and on February 7, 1867, the Agricultural College of West Virginia was established. The following year, President Alexander Martin succeeded in persuading the legislature to change the name of the institution to West Virginia University.

The major academic divisions of the University are: the College of Agriculture and Forestry; the College of Arts and Sciences; the College of Commerce; the Creative Arts Center; the School of Dentistry; the College of Engineering; the Graduate School; the College of Human Resources and Education; the School of Journalism; the College of Law; the School of Medicine; the Division of Military Science and the Division of Air Force Aerospace Studies; the School of Mines; the School of Nursing; the School of Pharmacy; and the School of Physical Education.

West Virginia University is a member of the North Central Association of Colleges and Secondary Schools. All of the University's educational programs are fully accredited by the North Central Association and by the appropriate accreditation agencies of the professional schools.

The University's total enrollment on September 30, 1968, not including extension, was 14,826. Of this number 2,888 students were enrolled in graduate and post-baccalaureate professional programs at Morgantown, 774 students were attending the Parkersburg Center, and 627 were enrolled at the Kanawha Valley Graduate Center.

The University year is divided into two semesters of approximately seventeen weeks each and a summer session of ten weeks.

MORGANTOWN AREA

Morgantown is a city of 25,000 population, although together with suburban communities, its metropolitan area population is estimated at 40,000. The major growth of Morgantown took place in the 1920's based on the coal-mining industry. Coal mining remains a major industry in the environs of the town, but with mechanization of its operations, it now accounts for only 10 per cent of the labor force. Meanwhile, education and ancillary services have taken the coal industry's place as the principal source of local employment. West Virginia University itself is by far the largest single employer, accounting for some 20 per cent of Monongalia County employment.

Located on the east bank of the Monongahela River, which flows north to Pittsburgh, Morgantown is situated on rugged terrain of the Appalachian Highlands. The altitude of the city varies from 800 to 1,150 feet above sea level, while the hills of the environs rise eastward to Chestnut Ridge which has altitudes of 2,600 feet just 10 miles from the city. Average temperature the year round is 50.6 degrees, with a summer average of 69.8 and a winter average of 25.3. Average annual rainfall is 40.61 inches. Morgantown's climate may therefore be described as temperate, with some features of a mountain environment.

Morgantown is served by bus and by air but not by passenger trains. Allegheny Airlines provides air service.

Limousine service to Grafton, 25 miles from Morgantown, connects with Baltimore & Ohio Railroad passenger trains.

U.S. Routes 19 and 119 pass through Morgantown in the north-south direction. Pittsburgh is 72 miles due north. The cities of Charleston, W. Va., Washington, Baltimore, Cleveland, and Columbus, Ohio, all lie from 200 to 220 miles distant. A north-south interstate highway, I-79, is being constructed to pass just west of Morgantown.

Because of West Virginia University's intellectual resources, the Morgantown area is becoming the major research center in the Appalachian region. Three federal agencies have located research facilities in the area—the Public Health Service (the Appalachian Environmental Health Laboratory and the Appalachian Laboratory for Occupational Respiratory Diseases), the Forest Service (the Forestry Sciences Laboratory), and the Appalachian Experiment Station of the U. S. Bureau of Mines.

Two new installations add to the area's variety. They are the Robert F. Kennedy Youth Center, a rehabilitation facility for youths who violate federal laws (mostly interstate car theft), and an earth tracking station of the Communications Satellite Corporation in neighboring Preston County (its 97-foot antenna sends and receives world-wide telephone and other communications from satellites in outer space).

PHYSICAL PLANT

West Virginia University's growth in physical facilities from 1957-58 through 1967-68 has been equaled by few universities of its size in the nation. During that decade, more than \$93 million in new buildings and facilities either have been built or are under construction on the Morgantown campuses.

They include a \$7.9 million Creative Arts Center; engineering and agriculture buildings costing \$10 million; the \$27.5 million Medical Center complex; \$18.4 million in dormitories and apartment; a \$2.4 million forestry building; \$4 million in chemistry facilities; a \$10.5 million fieldhouse; and the \$6.7 million activities center (Mountainlair) with its adjoining plaza and parking garage. A \$2.5 million Law Center to house the College of Law is being planned for the Evansdale Campus.

WVU has three campuses in Morgantown—the 75-acre downtown campus containing 46 buildings; the 275-acre Evansdale Campus, where future growth probably will be concentrated, with 10 buildings; and the 260-acre Medical Center Campus. A University-operated bus system, considered a model by other universities, connects the three campuses.

The University owns and operates experimental dairy, horticulture, animal husbandry, agronomy, and poultry farms in Monongalia County; and other farms at Kearneysville, Jefferson County; Wardensville, Hardy County; Reedsville, Preston County; and Point Pleasant, Mason County. Also, the Tygart Valley Experimental Forest, Randolph County; and University Forest, at Cooper's Rock, near Morgantown.

Area Appalachian Center headquarters, in addition to one in Morgantown, are in Beckley, Charleston (Institute), Jackson's Mill, Keyser, and Parkersburg, and there are county offices throughout the state. Camp Arthur Wood, a geology camp, was obtained in 1948 at Alvon, near White Sulphur Springs, Greenbrier County, and the Terra Alta Biological Station in 1950. A 75-acre Arboretum, containing almost every plant and flower native to West Virginia, is open to visitors at the Evansdale Campus.

WVU-KANAWHA VALLEY GRADUATE CENTER

The West Virginia University-Kanawha Valley Graduate Center (WVU-KVGC) was established at Institute in 1958. It is a fully integrated unit of West Virginia University's higher education system offering resident graduate credit. Its academic programs are coordinated with the graduate programs of the University. Close association with the University, with the area institutions of higher education, and with state and area program interests is maintained through a system of committees appointed by the President of the University and/or the West Virginia University Board of Governors.

Recent legislation and appropriations have made possible a material expansion in the Center's graduate programs and enrollment. The latter increased from 83 graduate students in the fall of 1966 to 627 graduate students in the fall of 1968. Forty-nine of the fall semester students were enrolled for cross-listed Marshall University course-credit.

Courses of instruction leading to the Master's degree in Business Administration, Chemistry, Chemical Engineering, Mechanical Engineering, Industrial Engineering, Political Science, Mathematics, and some areas of Human Resources and Education are presently available. Other graduate programs will be added whenever substantial demand for them can be demonstrated and when the academic quality of the program can be maintained.

The WVU-KVGC cooperates with Marshall University in a cross-listing of certain graduate education courses, which are approved by that institution for equivalent Marshall University graduate credit, thus permitting both Marshall University and West Virginia University registrants, who have been duly admitted to Marshall University or West Virginia University Graduate Schools, to apply the credit for cross-listed courses at their parent institution.

Primary functions of the WVU-KVGC are: (1) to offer both disciplinary and interdisciplinary graduate degree programs related to those needs; (2) to conduct both basic and applied research relevant to those graduate degrees; and (3) to conduct graduate level continuing professional development seminars, workshops, short courses, and similar series aimed at keeping the professional and already graduated and employed person abreast of new knowledge in his or her field.

Faculty. The faculty consists of full-time graduate faculty of the Kanawha Valley Graduate Center; full-time professors from the graduate faculty in Morgantown; lecturers from the faculty at Marshall University, and from the area colleges, and part-time fully qualified and experienced lecturers from local industries, businesses, governmental agencies, and other personnel approved by the academic unit and the Graduate School of West Virginia University for teaching specific graduate courses.

Offices and Classrooms. Most Kanawha Valley Graduate Center classes are held on the campus of West Virginia State College in Institute, West Virginia, a few miles west of Charleston. An administrative and clerical office and work area for commuting instructors is also located on that campus in Room 107, Library Building.

Additional classrooms and the main administrative and faculty offices of the Kanawha Valley Graduate Center are located on 19th Street, West (Plant Road) Nitro, West Virginia, a few miles west of the West Virginia State College campus.

For information about the West Virginia University-Kanawha Valley Graduate Center write to:

West Virginia University-Kanawha Valley Graduate Center
Post Office Box 547W
Nitro, West Virginia 25143, or phone: (304) 755-4313

GOVERNMENT AND ORGANIZATION OF THE UNIVERSITY

The Board of Governors is vested by law with authority for the control and management of the educational, administrative, financial, and business affairs of the University, whose chief executive officer is the president of the University. The board is bipartisan and consists of nine members appointed by the governor of the State with staggered terms of nine years. At least one member is appointed from each Congressional District, and at least four members must be graduates of West Virginia University. Members are eligible for reappointment.

The board also has responsibility for Potomac State College, a two-year institution at Keyser. Other public institutions of higher education in West Virginia are governed by the State Board of Education.

The President is the chief executive of the University. In this capacity, he is, *inter alia*, the principal academic officer and head of the faculties of the University, a role which his position as presiding officer of the University Senate symbolizes. The chief officers of administration, responsible and reporting directly to the President are: the Provost for Instruction, the Provost for Research and Graduate Studies, the Provost for Health Sciences, the Vice-President—Off-Campus Education, the Vice-President—Administration and Finance, the Vice-President—Planning, the Director of Student Educational Services and the Director of Development.

The University Senate was established by the Board of Governors in November, 1945, as the vehicle for faculty participation in the government of the University. It is a legislative body with original jurisdiction over all matters of academic interest and educational policy that concern the entire University or affect more than one college, school, or division. The Senate's decisions are subject to review and approval by the President and the Board of Governors.

A new constitution for faculty participation in University government was passed by a faculty referendum, approved by the Board of Governors, and put into effect through organization procedures in 1966. The chief provisions of the new constitution provide a representative Senate with broader powers and meeting more frequently (every month) than the former Senate. It includes the President of the University as Chairman, Provosts, Academic Dean, five administrative officers appointed by the President, and Senators elected by the members of the University Faculty Assembly to represent the 15 college constituencies and one other constituency. Each constituency is entitled to one Senator for each twenty constituents who are members of the University Faculty Assembly.

The University Faculty Assembly includes the President of the University as Presiding Officer, Provosts, Academic Deans, Professors, Associate Professors, Assistant Professors, and Instructors holding appointments on a full-time basis in the University, and such other persons engaged in full-time professional activities responsive to the academic obligations of the University as have been approved for Membership and Constituencies. The Faculty Assembly normally meets twice a year.

LIVING ACCOMMODATIONS

The University Housing Center, 440 Medical Center Road (phone [304] 293-3621), is the source of information concerning both University campus housing and privately-owned, off-campus housing. The University maintains seven residence halls, two for men and five for women. It also operates several hundred furnished and unfurnished apartments for married students, graduate students, faculty, and staff. There are many living accommodations in converted residences, in apartments, and in private homes, of which a few also board students. There is an increasing number of new large modern privately-owned dormitories and apartment houses near the campuses. Most of these have numerous units at reasonable rentals, but the earliest possible inquiries and attention to reservations are advised.

UNIVERSITY FINANCIAL STRUCTURE

As might be expected, West Virginia University, as a State institution, draws most of its revenue from public sources. The operations of the Medical Center are separately financed from those of the rest of the University out of proceeds of a legislatively dedicated tax on soft drinks.

Income

In fiscal year 1968, the University received revenues totaling \$57.8 million. The sources of these funds and the contributions of each as percentages of the total were approximately:

	PER CENT
1. Governmental appropriations (exclusive of income for contract research, grants, and services)	
State appropriations (includes funds for general operations, specific purposes, and proceeds for Medical Center dedicated tax)	42.8
Federal appropriations (includes funds for instructional purposes, agricultural extension and research and vocational training)	4.5
Local reimbursements2
2. Student tuition and fees for:	
Current operations	2.9
Capital improvement	10.6
3. Contract research, grants, and services:	
Federal	13.0
State5
Private6
4. Auxiliary enterprises (income producing enterprises such as housing and food services, book store, and intercollegiate athletics) . . .	10.3
5. Organized activities related to educational departments (income from enterprises conducted primarily for purposes of providing professional training to students such as University Hospital and Centers for Graduate and Undergraduate Studies)	10.1
6. Sales, services, and miscellaneous	3.5
7. Student aid income (scholarships, fellowships, loans, etc.)	1.0
	100.0

Expenditures

Total expenditures on current operations for fiscal year 1968 amounted to approximately \$49.7 million, which, by percentages, was allocated to the following categories:

	PER CENT
1. Administration and general	11.0
2. University libraries	1.8
3. Plant operation and maintenance	6.8
4. Resident instruction (total operating budgets of colleges and schools)	29.7
5. Organized activities related to instruction (including University High School, University Hospital, etc.)	16.7
6. Organized research	12.8
7. Organized extension	7.7
8. Intercollegiate athletics	2.0
9. Non-educational expense (Health Service, Alumni Association, University matching contribution for T.I.A.A., etc.)	4.4
10. Auxiliary enterprises and activities	7.1
	100.0

HEALTH SERVICE

The University Health Service provides medical care to students of the University and supervises general campus health conditions. The staff includes six full-time and four part-time physicians, four nurses, two laboratory technicians, and clerical personnel. The University Pharmacy, housed in the Health Center, is managed by the School of Pharmacy.

The Health Service occupies the Health Center on the Downtown Campus, constructed in 1942, and recently relocated and renovated. This three-story building is centrally located fronting on College Avenue at Maiden Lane. It is built of brick and concrete and is fireproof throughout. On the first floor are the treatment rooms, offices, and pharmacy. The second floor is occupied by laboratory and X-ray departments, and offices for physicians. The third floor houses the Student Counseling Service.

The Health Service is in operation from 8:00 A.M. to 5:00 P.M., daily, except Saturday and Sunday. Saturday hours are 8:00 A.M. to noon. Physicians are in attendance from 9:00 A.M. to noon, and 2:00 P.M. to 5:00 P.M. On Monday to Friday evenings a nurse is on duty at the Health Center from 7 to 10 P.M., with a physician from 8 to 10. A physician is present Saturday from 7 to 9 P.M., and on Sunday from 3 to 5 P.M. A University physician can always be reached by calling the Health Service, 293-2311, or the University telephone operator, 293-0111. Each regularly enrolled University student pays a fee which provides for medical consultation and advice from University physicians. Moderate additional charges are made for room calls, minor operations, treatment of fractures, and drugs furnished by the Health Service or Pharmacy.

Students who need bed care for medical illness are hospitalized at Station 71, University Hospital, which serves as the University Infirmary. The Infirmary is open only to full-time students. It is the policy of the Health Service to have all students requiring such care in the Infirmary. Students hospitalized in the Infirmary are under the care of Health Service physicians, although other qualified physicians may be seen in consultation when necessary. Patients will be admitted and discharged on the order of Health Service physicians.

Upon admission to the Infirmary the student receives two days of hospitalization without charge. Special nurses, when necessary, are at the expense of the student.

A student may not receive more than thirty days of hospitalization for any one illness. Patients are to leave when discharged by the University physicians. When it becomes evident that a student's illness will be so prolonged as to prevent his completing work of the current semester, he may be discharged from the Infirmary when the attending physician or the Director of the Health Service considers that he may be moved without undue danger to his health. The services as indicated above are subject to the availability of space in the Infirmary. Sixteen beds at present are ready for use.

Student Insurance

A voluntary insurance plan is available to students to supplement the medical care offered by the Health Service. The plan provides for payment for hospitalization, surgeon, and consultant's fees, and other medical costs throughout the year, both in Morgantown and elsewhere. For cost of this insurance and details concerning coverage see the brochure available at the Health Service.

A similar policy is available for the wives and children of students who have purchased the student insurance. See the Health Service for details.

STUDENT COUNSELING SERVICE

The University provides diagnostic testing and counseling for students with educational, vocational, and personal adjustment problems. These services are provided by counseling and clinical psychologists.

The Student Counseling Service is a voluntary, confidential resource for students. It is intended to serve students who want and need objective professional help in examining their own conflicts of motivation, feelings, or identity. Those in need of such help are not just the marginal and immature students, as might be supposed, but frequently the exceptionally able and conscientious students.

The counseling service should be regarded as a self-help resource for students. To be consistent with its particular usefulness, the service must be freely available on a confidential individual basis to those who can use it appropriately. Although similar in orientation and professional ethics, counseling service is not a form of medical treatment. Nor does it exist primarily to aid the University administration by screening students diagnostically or advising in discipline cases. The purpose is to provide a service directly to students.

If a student seeks aid from the service privately and on his own initiative, no consultation by the staff with anyone else is permitted without a request from the student. However, the faculty are invited to consult with the counseling staff on any student problem, prior to referral or without having referral in mind. Students have been helped by intelligent listening and counseling support from a sympathetic faculty member. Many of the faculty call upon the counseling service to discuss severe student educational or adjustment problems, whether tests might be helpful, and to request advice about alternative ways of approaching these problems.

The student may make his own appointment at the offices on the third floor of the Health Center, phone 293-4432.

VETERANS

The University recognizes that men and women from the Armed Forces who enter college require individual and personalized guidance in order to facilitate their entrance and to aid their adjustment to University life. The Veterans Coordinator is available for consultation and help in the solution of personal problems which may arise in the transition to civilian student life.

Information regarding educational opportunities made possible at the University through provisions of the Veterans Readjustment Benefits Act of 1966—G.I. Bill (Public Law 358), the Vocational Rehabilitation Program of the Veterans Administration (Public Law 16), and the War Orphan's Educational Assistance Act of 1956 (Public Law 634) may be obtained from the Veterans Coordinator by personal conference or by mail. An amendment to Public Law 634, passed by Congress in the summer of 1964, provides benefits to many dependents of 100 per cent disabled veterans.

FOREIGN STUDENTS

Of 229 foreign students from 45 different countries on the campus in September 1968, 166 were seeking Master's degrees or a Ph.D., and 63 were seeking undergraduate Bachelor's degrees.

The Foreign Student Office is located in Elizabeth Moore Hall. All new foreign students must contact the Foreign Student Office when they first arrive. The Foreign Student Adviser is available for guidance and counseling for individual foreign students. The Foreign Student Relations Committee of the Student Administration works closely with the office in an effort to bring the foreign and American students together for programs of international interest. Foreign students are encouraged to join the International Students' Association, an organization of foreign and American students interested in international relations. International students are also encouraged to join their particular nationality organizations. The Host Family Program provides foreign students an opportunity to meet and become acquainted with American families and visit in their homes.

All inquiries and applications from foreign students must be sent to the Director of Admissions. The Test of English as a Foreign Language (TOEFL) must be taken by all foreign students before they can be admitted to West Virginia University.

THE UNIVERSITY LIBRARY SYSTEM

The West Virginia University libraries contain approximately 800,000 volumes, 34,000 maps, 8,500 reels of microfilm, and over 50,000 technical reports. About 30,000 volumes are added each year, and 5,000 periodical titles are currently received. The bulk of this material is in the central Library on the Downtown Campus.

The central Library has developed strength in several fields. The collections in botany, chemistry, engineering, sociology, the Southern Appalachians, and West Virginia history are especially strong. Facilities for research in West Virginia and regional history are centered in the West Virginia Collection. In addition to an extensive collection of books, periodicals and maps, the collection contains over three million manuscripts. These, together with court records from many counties, are invaluable sources for the study of all aspects of West Virginia history.

The Rare Book Room contains an unusually fine collection of first and limited editions, including the four Shakespeare folios, and the first editions of many of the work of Dickens, Scott, and Clemens.

The Audio-Visual Department has some 1,800 educational films and 600 filmstrips, as well as 3,000 recordings.

During regular sessions, except on holidays and vacations, the Library is open from 7:55 A.M. to 11:00 P.M., Monday through Thursday; Friday, from 7:55 A.M. to 10:00 P.M.; from 7:55 A.M. to 5:00 P.M., Saturdays; and from 2:00 P.M. to 10:00 P.M., Sundays. During the Summer Session the weekday hours are from 7:55 A.M. to 9:00 P.M.; and only the Reserve Collection is available on Sundays, from 2:00 P.M. to 5:00 P.M. During periods when the University is not in session, the hours are from 9:00 A.M. to 5:00 P.M., Monday through Friday; 9:00 A.M. to noon Saturdays; closed all day Sundays and holidays (New Year's Day, Memorial Day, July 4, Labor Day, Thanksgiving Day, and Christmas Day). Changes in scheduled hours are posted in advance.

The Agriculture-Engineering Library, located on the second floor of the Engineering Sciences Building on the Evansdale Campus, consists of approximately 40,000 volumes, for which a public card catalog is maintained. In addition, cards for titles in the library are filed in the central Library catalog and are marked "Ag-Eng." Titles in the Agriculture-Engineering Library may be obtained either at the library or by applying at the central Library circulation desk.

The Chemistry Library, consisting chiefly of bound periodicals in the field of chemistry, is located in the new Chemistry Research Laboratory. Catalog cards for these volumes are available there as well as in the central Library catalog marked "Chem-Lib."

The 70,000 volume Law Library is located on the second floor of the Law Building. Students may use this collection by applying at that library.

The Mathematics-Physics Library, located in Rooms 305-306, Physics Building, consists of approximately 7,000 volumes. Catalog cards for titles in the Mathematics-Physics Library are filed both in that library and in the central Library catalog and are marked "Math-Phys Lib."

The Medical Center Library is located on the second floor of the Basic Sciences Building on the Medical Center Campus. It contains some 71,000 volumes with a complete public catalog. Author cards for titles in the Medical Center Library appear in the central Library catalog. Titles in the Medical Center Library may be obtained by applying at the circulation desk of the central Library.

COMPUTER CENTER

The main Computer Center is to be temporarily located on Chestnut Ridge Road opposite the Medical Center. An IBM 360/75 large scale general purpose electronic digital computer is to serve three high-speed remote batch processors and several multiprogramming low-speed remote typewriter and graphic terminals, with an operating system. Main memory consists of 512K bytes of high-speed core and

1,024K bytes of low-speed core. Secondary storage devices include a disk drive with a capacity of 233.4 million characters, two drums each capable of storing 3.9 million characters, and three high-speed tape drives.

In addition to the main Center, an IBM 7040 computer is maintained in the Administration Building to provide for the transition to the new IBM 306/75.

BOOK STORES

The Book Store on the Downtown Campus is in the wing of the Mountainlair. The Medical Center store is in the Basic Science Building, ground floor. The Evansdale Campus store is in the Engineering Sciences Building, ground floor.

The stores offer the following specialized merchandise and service: new and used textbooks; out-of-print and antiquarian books and search service for those not in stock; general books and paperbacks in all categories; art prints and artists' supplies; photographic equipment and supplies; medical and engineering instruments and supplies; and University-seal imprinted gift items and wearing apparel.

UNIVERSITY PLACEMENT SERVICE

The University Placement Service provides vocational and job selection assistance to students and alumni.

In addition to registration procedures, which include counseling in the techniques of job application, the service assists alumni seeking promotion or change of position, and cooperates with all individuals and agencies interested in placement. It develops credentials for registered students and alumni, which include data furnished by the registrants as well as the references that are written in their behalf to support their search for employment, and furnishes these credentials to potential employers. A meeting place is provided for students seeking jobs, visiting company, governmental and educational representatives, and faculty members whose comments are sought by employers. A library is maintained which provides occupational and vocational information for use of advisers as well as students. The service analyzes the job market and tries to keep up with the development of new careers and the changes in the requirements of existing ones.

INFORMATION AND OTHER MOUNTAINLAIR SERVICES

Mountainlair, the University center located on University Avenue, Downtown Campus, provides facilities and services of benefit to the graduate student. These facilities include lounges, meeting rooms, ballrooms, art gallery, browsing library, listening lounges, theater, snack bar, cafeteria, catering, the Rhododendron Room restaurant, bake shop, vending, arts and crafts, shop, ski rental, outdoor recreation equipment rental, bowling, table tennis, billiards, tour service for the University, campus information center, check cashing, check room facility, sundry shop, Xerox duplicating, cabinet rental for campus organizations, and programming which includes films, fine arts, social events and decorations, special events, forums, tournaments and games, housing, newspaper coverage, and public relations.

PARKING

Students are required to observe all rules and regulations of the University concerning automobile parking. Temporary visitors' permits, parking permit applications, and other parking information are obtainable from the Parking Control Office, Evansdale Campus.

CULTURAL ACTIVITIES

The University Cultural Series brings internationally recognized artists, theater repertory and ballet companies, symphony orchestras, and choral groups to the campus. It is funded by a \$2.00 student fee. Admission to these events is free to all full-time students, on presentation of validated identification cards.

Many cultural programs are presented without charge, including the convocation series which offers lecturers of national and international renown.

All performances of the resident artists, ensembles, some of the drama groups, and the fine arts exhibitions of the University Creative Arts Center are offered without charge. They include performances by resident artists, the University-Community Symphony Orchestra, the University Choirs, the University Choral Union, the American Arts Trio, the University Symphonic Band, Percussion Ensemble, Opera Theater, and senior and graduate student recitals. Fine arts exhibits are presented by the Division of Art and by Mountainlair. The drama productions of the University Players, for which season tickets or a ticket for each performance may be purchased at nominal prices, draw large audiences. Holders of Mountainlair cards may attend additional concerts, films, and lectures offered for students. The Film Society, sponsored by Mountainlair, regularly schedules showings of international cinema classics. The Creative Arts Center and all its productions are housed in a new building, including concert hall, theater, studios, and educational facilities. Cultural events are publicized in a weekly Calendar of Events and special announcements. They also are announced in the *Daily Athenaeum*, the Morgantown newspapers, and by means of posters.

Graduate students who wish to participate in musical groups as performers should inquire of the Division of Music where there are many such opportunities.

Many distinguished scholars lecture at the University each year under the sponsorship of the Provost's Office, the academic departments, Phi Beta Kappa, and other scholarly honoraries. These lectures are primarily directed to the specialized scholarly or professional interests of particular departments or colleges, but they are ordinarily open to members of the student body who may have an interest in them and they are so advertised.

STUDENT FINANCIAL AIDS

Information and guidance on loans for graduate students is available in the Financial Aids Office, Room 105, Martin Hall.

On-campus employment opportunities can be investigated at both the Financial Aids Office and the Personnel Office of the University at 116 Willey Street.

Financial award assistance for graduate students is usually based on initial recommendations by the department and school, division, or college in which the student is pursuing his studies. Information on fellowships, scholarships, grants, and assistantships at the graduate level is available at the Financial Aids Office.

ASSISTANTSHIPS, FELLOWSHIPS, AND TRAINEESHIPS

Over one-third of the graduate students receive financial support through the University during the course of a year. There are over 300 graduate teaching assistantships supported mostly from State appropriations; over 150 graduate research assistantships financed through State or federal funds, private grants, and contracts; and about 200 fellowships and traineeships derived from federal programs such as HEA, NASA, NDEA, NIH, NSF, VA, etc. and from industrial and other non-public agencies.

Stipends for assistantships are generally stated in terms of 9 or 12 months' appointments for half-time service, i.e. 20 hours service per week in the case of research assistantships, and the assisting with instruction of two courses or the equivalent in the case of teaching assistantships. Most fellowships and traineeships require

enrollment for full-time study but no formal teaching or research duties. Tuition and registration fees are generally remitted. Departments may occasionally make appointments for more than or for less than half-time service with proportionately adjusted compensation. In the latter cases, the remission of tuition and registration fees is also reduced proportionately. Assistants giving half-time service may take no more than 12 credit hours in any one semester according to regulations of the Graduate School. College and department regulations may be more strict in this regard.

Applications should be made by the first week in March to the Dean of the College concerned (not to the Dean of the Graduate School) the Directors of the Office of Research and Development, Water Research Institute, and the Regional Research Institute; or in the case of Agriculture and Forestry, Arts and Science, Engineering, and Medical Sciences, to the Chairman of the Department in which the student's course work will be pursued.

Agriculture and Forestry

Graduate research assistantships at stipends of \$3,000 and \$3,600 for those holding Bachelor and Master Degrees, respectively, are available on a 12-month basis for half-time service, permitting a maximum of 10 hours per semester and waiving of tuition in Agricultural Biochemistry, Agricultural Engineering, Agronomy and Genetics, Animal Industry and Veterinary Science, and Plant Pathology and Bacteriology. Research assistantships at stipends of \$3,000 are available also in Agricultural Education, Forestry, and Horticulture.

Teaching assistantships at stipends of \$2,400 on a 9-month basis requiring half-time service, permitting a maximum of 10 hours per semester and waiving of tuition, are available in Agricultural Education, Agronomy and Genetics, Animal Industry and Veterinary Science, Forestry, Horticulture, and Plant Pathology and Bacteriology.

Arts and Sciences

Biology—Teaching assistantships up to \$2,400 for 9 months, half-time service, tuition and biology fees exempt. Research fellowships and assistantships with stipends comparable to teaching assistantships.

Chemistry—Teaching assistantships starting at \$2,400 for 9 months, half-time service, tuition and chemistry fees exempt. Research fellowships and assistantships supported by contracts and grants from government, private and industrial sources. Stipends comparable to teaching assistantships.

English—Teaching assistantships up to \$2,000 for 9 months, half-time service, tuition exempt. After 24 hours of graduate credit, the amount increases.

Foreign Languages—French, German, Spanish, Latin—Teaching assistantships up to \$2,000 for 9 months, half-time service, tuition exempt.

Geology—United States Steel Foundation Fellowship at \$2,400 for 9 months, tuition exempt. Teaching assistantships up to \$2,400 for 9 months, half-time service, tuition exempt. Research assistantships supported by contracts and grants. Stipends comparable to teaching assistantships.

History—Teaching assistantship, up to \$2,000 for 9 months, half-time service, tuition exempt.

Mathematics—Teaching assistantships up to \$3,000 for 9 months, half-time service, tuition exempt.

Philosophy—Assistantships up to \$2,000 for 9 months, half-time service, tuition exempt.

Physics—Teaching assistantships up to \$2,400 for 9 months, half-time service, tuition exempt. Research assistantships supported by contracts and grants. Stipends comparable to teaching assistantships.

Political Science—Departmental assistantships up to \$2,000 for 9 months, half-time service, tuition exempt.

Psychology—Psychometric and laboratory assistantships up to \$2,200 for 9 months, half-time service, tuition exempt. Also USPHS and VA Traineeships at standard stipends.

Sociology—Departmental assistantships up to \$2,000 for 9 months, half-time service, tuition exempt.

Speech—Teaching assistantships, up to \$2,000, half-time service, tuition exempt.

Commerce

Business Administration and Economics—Teaching or research assistantship up to \$3,500 for 9 months, half-time service, tuition exempt.

Creative Arts (Art, Drama, Music)

Teaching, research, performance, and technical assistantships up to \$2,500 for 9 months, half-time service, tuition exempt.

Engineering

Teaching fellowships in aerospace, chemical, civil, electrical, industrial, materials science, mechanical, nuclear engineering, and theoretical and applied mechanics, up to \$3,800 for 9 months, half-time service, tuition exempt. Air pollution control, solid waste, water supply and environmental science, graduate traineeships from \$2,400 to \$3,600 for 12 months plus dependency allowance, tuition exempt.

Engineering Experiment Station

Research assistantships in aerospace, materials science, chemical, civil, electrical, industrial, mechanical, mining, nuclear, petroleum, and geological engineering, and theoretical and applied mechanics. Stipends \$175 to \$300 per month for 9 or 12 months, half-time service, tuition exempt.

Human Resources and Education

Clinical Studies—Research and teaching assistantships up to \$3,000 for 9 months, half-time service, tuition exempt.

Education—Research and teaching assistantships up to \$3,000 for 9 months, half-time service, tuition exempt.

Family Resources—Teaching assistantships at \$3,000 for 9 months, half-time service, tuition exempt.

Human Resources Research Institute—Research and teaching assistantships up to \$3,000 for 9 months, half-time service, tuition exempt.

Rehabilitation Counseling—Graduate traineeships for master degree candidates. Stipends: First 9 months, \$1,800, tuition exempt; second 9 months, \$2,000, tuition exempt.

Social Work—Graduate traineeships for master degree candidates. Stipends up to \$3,000 for 12 months, tuition exempt.

Institute of Biological Sciences

Teaching assistantships will be available for qualified students.

Journalism

Teaching assistantships up to \$2,000 for 9 months, half-time service, tuition exempt.

Medical Science

Support from training, research, and other grants in anatomy, biochemistry, microbiology, pharmacology, and physiology; stipends from \$2,400 to \$2,800 for 12 months. Additional allowances for dependents.

Physical Education and Safety Education

Teaching and research assistantships up to \$2,000 for 9 months, half-time service, tuition exempt.

Regional Research Institute

A limited number of part-time research fellowships are awarded to graduate students who demonstrate a strong aptitude and interest in regionally-oriented basic research in the social science. Awards in variable amounts up to \$3,700 for 9 months, tuition exempt.

West Virginia Center for Appalachian Studies and Development

Office of Research and Development—Research assistantships up to \$2,250 for 9 months and \$3,000 for 12 months, half-time service, tuition exempt.

Water Research Institute—Research assistantships up to \$2,700 for 9 months and \$3,600 for 12 months, half-time service, tuition exempt.

WVU Foundation Doctoral Fellowships

The West Virginia University Foundation, Inc. has announced a new series of three-year fellowships for outstanding entering doctoral students in Graduate School programs. Departments are selected each year to make nominations for these awards to the Dean of the Graduate School. Stipends are \$4,000 for full-time, full-year enrollment or pro-rated at \$333 per month during the 9 months of the regular academic year. Inquire of the Chairman of the Department of major field as to the availability of such a fellowship in that department.

AEC Special Fellowships in Nuclear Science and Engineering

West Virginia University is a participant in the United States Atomic Energy Commission Special Fellowship Program which offers full tuition fellowships in nuclear science and engineering to encourage promising students to undertake graduate studies in these fields. The fellowships are available for three years on a yearly renewable basis with annual stipends of \$2,400 for the first year, \$2,600 for the second year, and \$2,800 for the terminal year, plus an allowance of \$500 for each dependent. Applicants, who must be U. S. citizens, can obtain further information and application forms by writing directly to Fellowships Office, Oak Ridge Associated University, P. O. Box 117, Oak Ridge, Tennessee 37830. The final selection of appointees is made by a national fellowship board.

Danforth Graduate Fellowships

For men and women under 30 with no previous graduate study who wish to prepare for a career in college teaching. One year awards normally renewable for total of 4 years. Stipend up to \$2,200 with dependency and other allowances. Recommendations made during first semester of student's senior year by departments to the Dean of the Graduate School.

HEA Prospective Teacher Fellowships

A number of two-year fellowships are authorized for award through certain departments under Title V, Part C of the Higher Education Act of 1965 for full-time graduate study towards the master's degree. They are not awarded to experienced teachers but to U.S. citizen students seriously interested in a career in elementary or secondary education such as recent college graduates (baccalaureate degree not less than three years ago), other college graduates who have never taught, or other college graduates who have not taught in recent years.

Stipends are \$2,000 for the first academic year and \$2,200 for the second academic year plus allowances of \$400 for each eligible dependent. An additional stipend of \$400 plus \$100 for each eligible dependent is available for summer study.

Inquiries should be made of department of student's major.

Kent Fellowships

For men and women under 30 with some graduate work preparing for teaching or administration in American colleges and universities. Applications obtainable direct from Danforth Foundation, 607 North Grand Boulevard, St. Louis, Missouri 63103, for submission by December 17. Stipend up to \$2,800 with dependency and other allowances and renewal possible for total of 3 years.

NDEA Title IV Fellowships

The Office of Education, under provision of the National Defense Education Act of 1958, as amended, supports three-year pre-doctoral fellowships in departments recommended by the University and selected by the U. S. Commission of Education.

Candidates must be U. S. citizens or have permanent residence status and must certify intention to pursue a full-time course of study leading to a doctoral degree and interest in a career in college or university teaching. Stipends vary from \$2,000 for first year to \$2,400 for third year, plus allowances of \$400 per year for each dependent. Nominations are recommended by approved departments after the grant award in November.

NSF Graduate Traineeships

The National Science Foundation grants the University authority to select a number of trainees for study leading to master's or doctoral degrees in the mathematical, physical, medical, biological, engineering, and social sciences, and in the history and philosophy of science. Nominees must be U. S. citizens or nationals. Stipend is \$2,400 at first-year level, plus dependency allowance and opportunity of renewal. Nomination of trainees is by departments and selection is by a University interdisciplinary committee after the grant is awarded in January. These grants also provide for a limited number of summer traineeships for graduate teaching assistants.

NSF Graduate Fellowships

Available for U. S. citizens or nationals in the fields of mathematical, physical, medical, biological, engineering, and social sciences, and in the history and philosophy of science. The student applies directly to the Fellowship Office, National Academy of Sciences, National Research Council, 2101 Constitution Avenue, N.W., Washington, D.C. 20418. The student may select his own Graduate School, but it is his responsibility to obtain admission. Application deadline is about December 1.

Oak Ridge Fellowships

The opportunity to participate in the Graduate Fellowship Program of the Oak Ridge Institute of Nuclear Studies is open to qualified students in the fields of biology, chemistry, engineering, mathematics, physics, and other scientific fields. When certified by the University and after completion of his course work, the student has the opportunity to conduct research using the facilities of the Oak Ridge National Laboratory and other Oak Ridge facilities. The basic annual stipend is \$3,000 with an allowance of \$500 for each dependent. Tenure is for the last year of course work on-campus and/or the final dissertation year at the Oak Ridge National Laboratory. In some cases, graduate students may be offered the opportunity to acquire research experiences through summer appointments at Oak Ridge National Laboratory prior to the time they are qualified to receive a fellowship.

Public Health Service Predoctoral Fellowships

Available for U. S. citizens or those lawfully admitted to the U. S. for permanent residence having bachelor's degree or equivalent training. Graduate work must be in the basic sciences such as biology, chemistry, zoology, physiology, biochemistry, etc. as they relate to problems of health and disease. Among the social sciences, those areas such as psychology and sociology that relate to the problems of health and disease, and some interdisciplinary fields such as biostatistics, medical economics, cultural anthropology, etc. Stipend is \$2,400 at first year level with \$500 for each qualified dependent and certain travel expenses; up to \$2,800 for candidate in final year of doctorate program. Application by form from Chief, Career Development Review Branch, Division of Research Grants, National Institutes of Health, Bethesda, Maryland 20014.

Under Public Health Service Grants, there are graduate traineeships available which include the fields of Air Pollution Control Engineering and other environmental engineering fields. The level of these is from \$3,000 for first-year students to \$3,600 for post-master's students plus \$500 per dependent, certain travel allowances, and tuition exempt. Information on these particular traineeships is available from the Department of Civil Engineering.

U.S. Steel Fellowship in Geology

Inquire of Department of Geology.

Woodrow Wilson National Fellowship Foundation Program

This foundation conducts a national identification program of 1,000 designates for graduate study awards including 150 Woodrow Wilson Fellowships for first-year graduate study leading to careers in college teaching particularly in the humanities and social sciences. Applicants nominated by a faculty member by October 31. Stipend \$2,000, tuition, and dependency allowance. Further information from Woodrow Wilson National Fellowship Foundation, Box 642, Princeton, New Jersey.

Additional Reference to Fellowship Opportunities

"A Selected List of Major Fellowship Opportunities and Aids to Advanced Education for United States Citizens" provides excellent short summaries concerning sources of support for graduate study and research. Obtainable from the Fellowship Office, Office of Scientific Personnel, National Research Council, 2010 Constitution Avenue, Washington, D.C. 20418.

Stipend Payment Dates For WVU Foundation, HEA, NASA, NDEA, and NSF Trainees and Fellows

The start of entitlement periods under these awards is usually September 1 of each year. Invoices for payments are prepared in the Office of the Graduate School each month between the 10th and the 15th for entitlements earned during that month. Checks are normally available at the Office of the Graduate School for the students on the first day of the next month. Students to receive stipends under these programs must arrange their finances accordingly for their needs from the start of the fall semester to October 1.

Applications and Proposals for Research, Demonstration, and Teaching Grants

Numerous graduate assistantships for research, demonstration, and training projects are supported through funding by agencies and organizations outside the university. All proposals for these and also proposals for equipment and facilities must be submitted by the West Virginia University Board of Governors under cover and letterhead of the Board and signature of the President of the University as Chief Executive Officer of the Board of Governors. These proposals are processed through Professor George E. Kirk, Assistant to the President for Grants and Contracts, Room 106, Oglebay Hall.

Part II / Academic Information and Regulations

The Graduate School was established by Board of Governors order in 1930 with the declaration that its "roots are implanted in all University undergraduate work, irrespective of colleges, schools, or departments. The Graduate School is empowered: (1) to direct research and investigation with particular reference to problems of the State, and (2) to train and recommend to the Board of Governors candidates for such graduate degrees as shall have been authorized." It follows that the Graduate School, as distinct from other colleges and schools, is a University-wide institution, drawing together all the faculties and students of the University concerned with graduate study, and empowered to establish: policies and regulations covering the introduction of degree programs; degree, curricular, thesis, and dissertation requirements; standards of student scholarship; residency rules, etc., which take precedence over the policies and rules of particular colleges, schools, and departments.

All decisions on major policies and regulations affecting graduate study and the introduction of new degree programs are based on recommendations made by the Graduate Faculty, after study and advice by the Executive Committee of the Graduate Faculty and the Dean of the Graduate School. Responsibility for determining graduate faculty membership is essentially in the hands of the Executive Committee, acting on recommendation from the staff member's department chairman. The Executive Committee consists of eight members, the Provost for Research and Graduate Studies and the Dean, *ex officio*, and six graduate faculty members elected at large by the graduate faculty for staggered terms of three years. The Executive Committee normally meets once a month and calls meetings for the Graduate Faculty twice during the academic year.

In practice, much of the day-to-day administration of graduate study is conducted by the departmental chairman or graduate advisers responsible for the particular programs. At the University level, responsibility for administration of the graduate faculty's policies and regulations, resolving problems of interpretation of these rules, keeping student records, and preparing graduation lists is vested in the first instance in the Dean of the Graduate School (Graduate School Office, Room 104, Oglebay Hall).

Two copies of *all* documents concerning a graduate student (on admissions, appointment of committees, announcement of qualifying and final examinations, etc.) are required, one to be forwarded to the office of the Graduate School for approval and/or inclusion in the student's file there, and the other to be included in the student's file in the Department of the student's major.

STUDENT CONDUCT

It is expected that students will come to the University with an earnest purpose to obtain an education and to apply themselves to that end. It is therefore expected that students will so conduct themselves as good citizens both within and without the University. To this end it is expected that they will conform to rules and regulations governing conduct and the use of facilities on the campus and that they will set for themselves a standard of personal conduct which will conform to the general community morals with respect to honesty, integrity, and respect for the property and rights of others. It is therefore University policy that the student is required to conform to rules, regulations, laws and ordinances governing conduct as may have been promulgated by state and local governing bodies as well as the Board of Governors of West Virginia University.

It is expected, furthermore, that students will observe rules and regulations promulgated by the University for the purpose of insuring the peaceful and efficient conduct of the academic affairs of the University. These rules will govern conduct in facilities, the classrooms, and other areas of contact.

In addition to the foregoing, the University has promulgated certain rules and regulations covering cheating and the prosecution of cases involving violation of those rules. Reference is made to the *Undergraduate Catalog* for specific exposition of those rules and these rules are made applicable to graduate students as if fully rewritten herein.

ADMISSIONS

General

Prospective graduate students are strongly urged to initiate their admission applications as early as possible. March application for September admission is reasonable procedure.

Applications for admission to the Graduate School must be made on standard forms obtainable from the Office of Admissions. Applications must be submitted to the Office of Admissions and *not* to the Office of the Graduate School. The completed application forms must be accompanied by payment of a non-refundable special service fee of \$10.00. The applicant must at the same time request the registrar of the college of his baccalaureate degree to send an official transcript of his record directly to the Office of Admissions. The applications and transcript should be received at least one month in advance of registration.

Any student with a bachelor's degree who wishes to enroll in a 200-level or 300-level course who has not been formally admitted to a second bachelor's degree program must first be admitted to the Graduate School.

All students applying for admission to the Graduate School of West Virginia University must be approved by the department of their major interest before they will be officially admitted as graduate students by the Office of Admissions.

Students may be approved by the department of their major interest as:

1. *Regular graduate students.* Such students have been approved by a department for entrance into a degree program and have been officially admitted by the Office of Admissions.

2. *Probationary graduate students.* A probationary graduate student is one who has been approved for a degree program by the department of his major interest with a grade-point average below that required by that department, or whose grade-point average has fallen below that required of all degree candidates.

3. *Special graduate students.* A special graduate students is:

- a. One who is not pursuing a degree program.

- b. One who is in the process of removing deficiencies prior to approval for a degree program.

All departments shall require an undergraduate grade-point average of at least 2.5 for approval of candidates as regular graduate students. All departments shall require an undergraduate grade-point average of at least 2.0 of candidates for approval as probationary graduate students. All departments shall require that probationary graduate students achieve a cumulative graduate grade-point average of 2.5 at the end of the semester in which they complete their 12th semester hour of graduate work at West Virginia University. A department shall not permit students to continue in graduate programs unless they meet this requirement.

All departments shall require that graduate students maintain a graduate grade-point average of at least 2.5 to continue as regular graduate students. A student whose grade-point average falls below the requirement for regular graduate student status shall be placed on probation and required to remove his deficiency during the next semester in which he enrolls. If he fails to do so, he shall not be permitted to continue in the Graduate School.

A graduate grade-point average of at least 2.5 will be required for graduation from West Virginia University with a graduate degree.

Nothing in the foregoing prevents any department from establishing additional and higher requirements. These are described in Part IV.

The Director of Admissions forwards a copy of the application to the department of the applicant's choice and will inform the applicant of the actions taken.

If the applicant is admitted or provisionally admitted, he will be informed whether or not the department will approve his pursuing a degree program and any conditions thereof. Final approval is conditional upon receipt of a complete official final transcript (or transcripts) of previous college studies.

All graduate students are further classified as full-time or part-time students. A full-time student is one who is registered for 9 to 15 semester hours of work during a semester of the regular academic year, for 6 to 12 hours during the full 10-week summer session, and for 3 to 6 hours during a 5-week summer term. Graduate students registering for fewer hours than those listed above are classified as part-time students.

Graduate Record and Other Examinations

The College of Human Resources and Education and certain departments of other WVU colleges require GRE scores before admission from all of their graduate students including those with a previous graduate degree. Some departments require scores *both* from the aptitude tests and the appropriate advanced test before making a decision on the admission application. Some departments require other tests such as the Miller's Analogy.

Students should arrange to take the tests required by the department of their prospective major (see Part IV) prior to the graduate registration at the University. If Graduate Record Examinations are required, the student should request the Educational Testing Service to forward their scores to the WVU department concerned.

Those planning to take the GRE must mail completed forms so as to reach the Educational Testing Service, Princeton, New Jersey, at least eighteen days prior to the date of the examination. The forms and examination dates are a part of the GRE information packet available at the WVU Graduate School Office or at other college centers throughout the country. The fee for the aptitude examination is \$7.00; for an advanced examination, \$8.00, and for both examinations, if taken on the same day, \$12.00.

Foreign Students

All foreign student applications for admission must be submitted to the Director of Admissions with a satisfactory score on "The Test of English as a Second Language (TOEFL)" at least four months in advance of the proposed date of entry. Information on location of testing centers, dates of testing, and application forms should be obtained from TOEFL, Educational Testing Service, Princeton, N. J. 08540, U.S.A.

Petitions by Seniors for Graduate Credit

Seniors in the colleges of West Virginia University and in colleges where West Virginia University offers graduate courses by extension who are within 10 semester hours of graduation may, with the prior approval of the Dean of the Graduate School on special senior petition forms, enroll for graduate courses for which they may receive graduate credit after obtaining the baccalaureate and after being admitted to the Graduate School. Such graduate courses must not have been offered for undergraduate credit, and in every case the petition must have been approved before or at the time of enrolling for the course or courses. The maximum amount of graduate credit permitted under this regulation is 15 hours. Combined graduate and undergraduate credit must not exceed 18 hours in one semester or 12 hours in the summer session.

THE ADVISER

Each department or other academic unit through which graduate degree programs are administered has one or more graduate advisers who are members of the graduate faculty. Every graduate student is assigned to such an adviser who arranges a specific cohesive, unified, continuous program of study with the student as early as possible before or after his first enrollment. The program is subject to approval by the Dean of the Graduate School and made a part of the student's records. The adviser will preside at the student's qualifying and final examinations.

REGISTRATION REQUIREMENT

Each graduate student must be registered during the semester or session in which he takes the final examination. This requirement may be met by paying the "fee for examination of a candidate for a graduate degree" at the Comptrollers Office in the Administration Building prior to the final examination.

CANDIDACY

Admission to candidacy for any graduate degree is an additional requirement over and above admission to the Graduate School and admission to a graduate program in a particular department, school, or college. A candidate for a graduate degree is a student who has satisfactorily completed a suitable period of graduate work in residence as a regular graduate student in which ability to do work of graduate caliber is demonstrated to the satisfaction of his adviser and graduate committee. It is usually established by successful completion of a departmental qualifying examination as further explained in the following pages under requirements for the Doctor's degree, and in Part IV of these *Announcements*.

CREDIT LIMITATIONS

General

Credit toward a graduate degree may be obtained only for courses listed in these *Announcements* and numbered 200-399. No residence credit will be allowed for special field assignments or other work taken off the university campus without prior approval by the Dean of the Graduate School.

No more than 15 hours of graduate course in any one semester, no more than 12 hours of graduate courses in any one 10-week summer session and no more than 6 during a 5-week summer term may be carried by a student. Any exception to this rule must be approved by the Dean of the Graduate School.

Transfer Credit

No more than 12 hours of graduate credit obtained at other approved institutions may be considered for transfer toward meeting the requirements for the Master's degree at West Virginia University. Approval in writing from the Dean of the Graduate School must be secured in advance to take graduate courses offered elsewhere. Graduate credits so accepted must meet requirements for a continuous and unified program of graduate study. They will reduce correspondingly the number of hours of extension graduate credits which may be accepted toward meeting the requirements for the Master's degree. The total of transfer plus extension credits applicable toward the degree is 15.

The above regulation applies to all Master's degrees based on a total credit requirement of 30 to 46 semester hours. The degree of Master of Social Work is based on a total credit requirement of not fewer than 61 semester hours, 24 to 30 of which may be transferred under suitable conditions, but the last 30 of which must be earned and completed at West Virginia University.

Extension Credit

No credits earned by extension prior to admission to the Graduate School and acceptance to a degree program of graduate study may be counted toward the Master's degree except under the senior petition regulation. No more than 15 hours of extension credit or combination of extension credit and transfer credit may be counted toward the Master's degree.

For majors in the Division of Education of the College of Human Resources and Education no more than 9 hours in extension may be obtained before the student completes at least 6 hours in residence on the campus. Full-time in-service teachers may obtain no more than 9 semester hours of credit toward the Master's degree in

any one academic year. The maximum amount of extension graduate credit that may be received in any one field is 9 semester hours.

Employed Graduate Students

Graduate students will be required by their advisers to limit their credit loads in proportion to the outside service rendered and the time available for graduate study. In general, persons in full-time service to the University, or other employer, will be advised to enroll for no more than 6 hours of work in any one semester and those in half-time service for no more than 12 hours. Maximum credit loads may be less for employed graduate students in some academic colleges and departments.

Maximum Time for Completion

Completion of requirements for any graduate degree must be accomplished within a period of 7 years. For a Master's degree the period starts at the initial enrollment for a graduate course after the Bachelor's degree is conferred. The same is true for a Doctoral degree, although when there is an intervening award of a Master's degree the seven-year period for completion of the Doctorate starts at the initial enrollment for a graduate course after the Master's degree is conferred. Credits lost at the beginning of a graduate program under this regulation will not usually be considered for revalidation and then only upon formal petition to the Dean of the Graduate School by the student's graduate adviser or committee chairman showing a completion program which the student must meet.

SCHOLARSHIP

To be in good standing, a graduate student must maintain a cumulative graduate course grade-point average of 2.5. A student whose grade-point average falls below 2.5 will be placed on probation and required to remove the deficiency during the next semester for which he enrolls. If he fails to do so, he shall not be permitted to continue in the Graduate School. A student who fails one-half or more of the work for which he is enrolled during any semester or summer session will be suspended. This regulation is a minimum standard for the Graduate School and the higher scholarship requirements that most departments have must also be met. A student who has not been accepted in one of the graduate student categories by the department of his choice may not enroll in courses. If he enrolls in such courses, his enrollment may be withdrawn. Credit hours for courses in which the grade is lower than "C" will not count toward satisfying graduate degree requirements.

PROBLEM REPORTS, THESES, AND DISSERTATIONS

These shall be presented to the student's departmental graduate adviser or committee chairman at least one month for masters candidates and two months for doctoral candidates before the end of the semester or summer session in which completion of all requirements is expected. The form prescribed under the Graduate School "Regulations Governing the Preparation of Dissertations, Theses, and Problem Reports" must be followed with the guidance of the student's graduate adviser or chairman of the student's graduate committee. In order for the manuscript to be approved there shall be no more than one unfavorable vote among members of the student's committee. Two accepted copies in approved typewritten form (problem reports and thesis in bound form and dissertations unbound) shall be delivered to the Office of the Graduate School at least one week before the close of the period in which the degree work is expected to be completed (one week before the end of the summer session, one week before the end of the final examination period at the end of the first semester, or one week before Commencement Day at the end of the second semester). Additional regulations are described under specific degree requirements in the following pages, and in the "Information and Check Lists for Masters Candidates" and a corresponding leaflet for Doctoral Candidates available at the Office of the Graduate School.

FINAL EXAMINATIONS

The final examination shall not be given until the semester or summer session in which all other requirements for the degree are to be met. In programs requiring a problem report, thesis, or dissertation the final examination must follow committee approval of the manuscript. The student's adviser or committee chairman must notify the Office of the Graduate School in advance of the time, place, and recommended examining committee membership and receive back clearance in the form of the student's "Shuttle Sheet" before the examination can be given. Such notifications of doctoral examinations must be received in the office of the Graduate School at least three weeks in advance of the examination date. All doctoral final oral examinations are open examinations and the lead time is required for public notice to the University community. Examining committees shall be comprised of no fewer than three members for the Master's degree and no fewer than five members for the Doctor's degree. The majority must be members of the Graduate Faculty and it is customary to have at least one member from a department other than that of the student's major field. Every doctoral committee must include at least one member of a department other than that of the major field of the doctoral program. The student cannot be considered as having satisfactorily passed the final examination if there is more than one unfavorable vote among members of the examining committee. Results of each examination must be reported to the Office of the Graduate School. Re-examination may not be scheduled without approval of the Dean of the Graduate School.

REQUEST FOR DEGREE

At the time of registration for the semester or the summer session in which all degree requirements are expected to be met, or at the latest within two weeks after such registration, each candidate shall submit a formal request on a special "Application for Graduation and Diploma" form to the Dean of the Graduate School for the conferring of the degree. The candidate must complete all requirements at least one week before the end of that semester or summer session.

COMMENCEMENT ATTENDANCE

Students graduating as of the close of the second semester are required to participate in the commencement exercises unless excused in writing by the Dean of the Graduate School. Students graduating as of the close of the summer session and as of the close of the first semester are not required to participate in the commencement exercises but are invited to do so. All doctoral graduates as of the close of the first semester or as of the close of the summer session must notify the Office of the Graduate School as to their participation in the commencement exercises.

THE DEGREES OF MASTER OF ARTS AND MASTER OF SCIENCE

Requirements

General: The regulations governing admission, registration, establishment of candidacy, scholarship, thesis and problem reports, final examinations, etc. described in the preceding sections must be followed. These are also summarized in the "Information and Check List for Masters Candidates" available at the Office of the Graduate School.

Program: No less than 30 hours of graduate work planned with the student's graduate adviser must be satisfactorily completed within a period of seven years immediately preceding the conferring of the degree. The program must be formulated in writing at the earliest possible date so as to result in a cohesive, unified and continuous plan of study. In degree programs requiring a thesis or problem report,

appropriate courses may be taken to cover the research and writing, but no more than 6 hours of credit earned for research or thesis may be counted in meeting course requirements for the degree. In most departments the program consists of certain amounts of work in major and minor fields. These are described in the departmental programs of Part IV in this bulletin.

Special: Each student, through consultation with his graduate adviser, must meet the special requirements of the faculty of the field in which he pursues his major study, subject to approval of the Dean of the Graduate School.

Degrees

Fields or Departments through which these degrees are offered are as follows:

Master of Arts (A.M.) with a major in:

Art	Latin American Area Studies
Biology	Library Science
Counseling and Guidance	Mathematics
Drama	Philosophy
Economics	Political Science
Education	Psychology
English	Reading
French	Sociology
Geology	Spanish
German	Special Education
History	Speech

Master of Science (M.S.) with a major in:

Agricultural Bacteriology	Mathematics
Agricultural Biochemistry	Microbiology (Med. Bacteriology)
Agricultural Economics	Orthodontics
Agricultural Education	Pharmaceutical Sciences
Agricultural Microbiology	Pharmacology
Agronomy	Physical Education
Anatomy	Physics
Animal Nutrition	Physiology and Biophysics
Animal Science	Plant Pathology
Biochemistry (Medical)	Plant Physiology
Botany	Recreation
Chemistry	Rehabilitation Counseling
Entomology	Reproductive Physiology
Family Resources	Safety Education
Food Science	Speech Pathology and Audiology
Genetics	Statistics
Geology	Wildlife Management
Health Education	Wood Science and Technology
Horticulture	Zoology
Industrial Relations	

Master of Science in the following designated fields:

Aerospace Engineering (M.S.A.E.)	Journalism (M.S.J.)
Agricultural	Mechanical
Engineering (M.S.Ag.E.)	Engineering (M.S.M.E.)
Chemical Engineering (M.S.Ch.E.)	Mechanics (M.S.T.A.M.)
Civil Engineering (M.S.C.E.)	Engineering of Mines (M.S.E.M.)
Electrical Engineering (M.S.E.E.)	Petroleum
Engineering (M.S.E.)	Engineering (M.S.Pet.E.)
Forestry (M.S.F.)	Nuclear Engineering (M.S.N.E.)
Industrial Engineering (M.S.I.E.)	

Other designated Master's degrees:

Master of Agriculture (M.Ag.)

Master of Business Administration (M.B.A.)

Master of Music (M.M.)

Master of Social Work (M.S.W.)

THE CERTIFICATE OF ADVANCED STUDY

This Certificate is conferred for successful completion of a program through the College of Human Resources and Education for students who have a Master's degree (see page 164).

THE DEGREE OF DOCTOR OF PHILOSOPHY

General Requirements

The regulations governing admission, registration, scholarship, etc., described in the preceding sections must be followed. Students applying for admission to a doctoral program after having received a Master's degree at West Virginia University must file a new completed form for admission to the Graduate School with the Office of Admissions. This is to insure the intent and proper records of the student and does not entail an additional admissions special service fee.

Candidacy Requirements

Admission to the Graduate School and enrollment in graduate courses does not of itself imply acceptance of the student as a candidate for a Ph.D., degree. This is only accomplished by (1) satisfactorily passing a comprehensive preliminary or qualifying examination (either oral, or written, or both) and (2) by meeting the Ph.D. language requirements.

(1). *Qualifying Examination*: After a period of residence the student will be admitted to a comprehensive examination in which he must demonstrate a grasp of the important phases and problems of the field of study in which he proposes to major; their relation to other fields of human knowledge and accomplishments; and the ability to employ rationally the instruments of research that have been developed in his major field. The scheduling and results of each such examination must be reported to the Office of the Graduate School (see Final Examination, page 31).

(2). *Foreign Language Examinations*: The foreign language requirement of the Graduate School is that the student demonstrate the ability to read one foreign language in a satisfactory manner. This may be any language in which there exists a significant literature in the student's major field of study, and which is acceptable to the student's major department and to the Dean of the Graduate School. For any language other than French, German, or Russian, approval of the Dean must be requested by the student's adviser.

The Ph.D. programs offered through a number of departments require a reading knowledge of two foreign languages or of one language in greater depth than the minimum requirement of the Graduate School.

Language examinations are arranged by the Foreign Language Examiner who is a member of the faculty and is appointed by the Dean of the Graduate School with the advice of the chairman of the Department of Foreign Languages. Examinations are administered by a person or persons selected by the Foreign Language Examiner at stated times, in general, twice each semester and once during the summer. Material in the student's field of specialization is approved by the adviser, and the student is allowed to prepare in advance for examination of this material. When translating unfamiliar material, the student will be allowed to use a dictionary. If a student fails the examination, his adviser may request a review of his examination papers. This review will be conducted by a committee of three members appointed by the Dean of the Graduate School. One member of the committee shall be a

member of the faculty of the Department of Foreign Languages. The Foreign Language Examiner shall report to the student's adviser and to the Dean of the Graduate School the results of language examinations and examination reviews.

The completion of 12 semester hours or equivalent of course work in an approved foreign language with a grade of B or better in the last three hours at West Virginia University or at any other institution or recognized standing, will be accepted as satisfying the reading requirement of a language, provided that it was completed no more than three years prior to application of language certification. The reading requirements of one or both languages may be satisfied in this way but must be approved by the Foreign Language Examiner.

The completion of French 206 at West Virginia University with a grade of B or better as a graduate student or within two years of applying for language certification will be accepted as satisfying the reading requirement in French.

When a student has successfully completed his qualifying examination and has satisfied his foreign language requirements he is promoted to candidacy for the Ph.D.

Program

The program of Ph.D. study is planned with the student's graduate adviser and committee to combine any or all of the following: Graduate courses of instruction, special seminars, independent study, supervised research, and supervised teaching designed to promote a broad and systematic knowledge of his field and to prepare the student for the comprehensive qualifying and final examinations and writing of the dissertation.

Residence

The program for the Ph.D. generally requires at least three years of full-time graduate work beyond the Bachelor's Degree. This must include a minimum of two semesters of residence in full-time graduate study at West Virginia University.

Dissertation

The candidate must submit a dissertation pursued under the direction of the faculty of this University on some topic in the field of the major subject. The dissertation must present the results of the candidate's individual investigation and must embody a definite contribution to knowledge. While conducting research or writing a dissertation the student must register at the beginning of each semester or summer session during which credit is being earned.

Special Requirements

The student must satisfy such special requirements, subject to the approval of the Dean of the Graduate School, as may be required by the faculty responsible for his major field. All of the requirements for the degree shall be completed within a period of seven years.

Final Examination

If the candidate's dissertation is approved and he has fulfilled all other requirements, he will be admitted, upon proof of current registration and approval by the Dean of the Graduate School, to a final oral examination on his dissertation before his examining committee. At the option of the department or the committee, a comprehensive final written examination also may be required. Results of the examination, acceptance of the dissertation, and certification of its suitability for immediate publication must be reported by the committee chairman to the Office of the Graduate School not later than one week before the end of the semester or summer session in which the degree is expected to be granted (one week before the end of the summer session, one week before the end of the final examination period of the end of the first semester, or one week before Commencement Day at the end of the second semester).

Publication of the Dissertation

All Ph.D. and other Doctoral Dissertations and their abstracts will be micro-filmed through University Microfilms, Ann Arbor, Michigan. This requirement will not be satisfied by any other publication but does not preclude publication elsewhere which is both permitted and encouraged.

Candidates are to follow "Regulations Governing the Preparation of Dissertations, Theses, and Problem Reports" regarding format, paper, and organization of the dissertation and "A Review of Copyright Matters Related to Graduate Theses and Dissertations" for information pertaining to copyrights. Both of these papers are on file at the Office of the Graduate School, Department offices, offices of all Graduate Advisers, and the University Libraries. The candidate is required to maintain close contact with his supervisor or chairman of his graduate committee on these matters in developing his dissertation so as to incorporate the special requirements of the subject discipline.

One week before the close of the semester or summer session in which the degree is expected to be conferred the candidate must meet the following requirements as well as others described in the "Information and Check List for Doctoral Candidates" obtainable at the office of the Graduate School:

1. Submit to the Office of the Graduate School, in form satisfactory for micro-filming, the typewritten, unbound original and first carbon copy of the dissertation signed by the candidate's committee. Two excellent machine-reproduced copies may be acceptable if approved in sample in advance and final copies conform.

2. Submit to the Office of the Graduate School one abstract as above of the dissertation consisting of no more than 600 words.

3. Submit to the Office of the Graduate School a microfilm contract completed and signed by the candidate.

4. Pay a fee of \$30.00 at the Office of the Graduate School to cover the cost of microfilming the dissertation and publication of the abstract in *Dissertation Abstracts*, a bi-monthly journal which receives wide distribution. Check must be made out to "Dissertation Service." If copyright service is desired, it can be provided through the Office of the Graduate School upon receipt along with the dissertation of a certified check for \$10.00 made payable to "University Microfilms."

5. Complete the questionnaire entitled "Survey of Earned Doctorates" obtained at the Office of the Graduate School and return it there.

Major Fields

Programs toward the Ph.D. are offered in the following major fields:

Aerospace Engineering	History
Agricultural Biochemistry	Mechanical Engineering
Agricultural Microbiology	Microbiology (Medical)
Agronomy	Music
Anatomy	Pharmacology
Animal Nutrition	Physics
Biochemistry (Medical)	Physiology
Botany	Plant Pathology
Chemical Engineering	Plant Physiology
Chemistry	Political Science
Civil Engineering	Psychology
Economics	Reproductive Physiology
Electrical Engineering	Theoretical and Applied Mechanics
Genetics	Zoology
Geology	

THE DEGREE OF DOCTOR OF EDUCATION

The degree of Doctor of Education is offered through the College of Human Resources and Education. Programs leading to the degree with a major in Music Education are offered cooperatively with the Creative Arts Center (see p. 112) and those leading to the degree with a major in Physical Education or Safety Education are offered cooperatively with the School of Physical Education (see p. 224). The major fields are:

Curriculum and Instruction
Educational Administration
Guidance and Counseling
Health Education
Music Education

Physical Education
Reading
Safety Education
Special Education
Speech Pathology and Audiology

THE DEGREE OF DOCTOR OF MUSICAL ARTS

The degree of Doctor of Musical Arts is offered through the Creative Arts Center. The degree program is described on page 116.

Part III / Financial Information and Regulations

FEES AND EXPENSES

All University fees are subject to change without notice.

A non-refundable special service fee of \$10.00 must accompany applications for admission to the Graduate School.

All fees are due and payable at the Comptroller's desk in the Field House Annex (south) on the days of registration. Students must pay fees before registration is accepted and class tickets are released. Completion of arrangements for payment from University payroll check, officially accepted scholarships, loan funds, grants, or contracts shall be considered sufficient for acceptance of registration. Fees paid after regular registration must be paid at the Comptroller's office in the Administration Building. Any student failing to complete registration on regular registration days is subject to the Late Registration Fee of \$10.00. Students registering pay the fees shown on page 35 plus special fees and deposits as required.

By order of the Board of Governors, no degree will be conferred upon any candidate prior to payment of all tuition, fees, and other indebtedness to any unit of the University.

Special Fees

Late-registration Fee (non-refundable) ¹	\$ 10.00
Graduation Fee ²	10.00
Professional Engineering Degree (including \$10.00 graduation fee)	25.00
Student's Record Fee ³	1.00
Fee for Change in Registration (after 8th day)	1.00
Fee for Examination for Entrance Credit, per unit	1.00
Fee for Examination for Advanced Standing	3.00
Fee for General Educational Development Tests (high-school level) ⁴	15.00
Certificate of Advanced Study	2.00
Fee for Reinstatement of Students Dropped From the Rolls	3.00
Fee for Examination of Candidates for Graduate Degree ⁵	1.00
Diploma Replacement Fee	5.00
Physical Education Student Fee	5.00
Student Identification Card Replacement Fee	1.00
Correspondence Course in Guided Reading (per course)	1.00
Driver Education Laboratory Fee	10.00
Labor Education Service (for informal activities)	2.00-10.00
Social Work Field Supervisory Fee (per semester)	70.00

Student Union Fee and Daily Athenaeum Fee

The following fees are charged all students, full-time and part-time, who are enrolled for regular courses of resident instruction at West Virginia University in Morgantown:

Student Union Fee	\$20.00 per semester
Daily Athenaeum Fee	\$ 1.50 per semester
Student Union Fee	\$12.00 per summer term in excess of five weeks
Student Union Fee	\$ 6.00 per five-week summer term or any portion thereof
Daily Athenaeum Fee	\$ 1.00 per full Summer Session

These fees are non-refundable unless the student withdraws officially before the close of General Registration for the term of course in which he has been enrolled.

Fees for Extension Courses

A fee of \$12.00 per semester hour and an off-campus extension fee of \$12.00 per course are charged for enrollment in each extension course. Fees for extension courses are due and payable at or prior to the first class meeting.

Semester Fees in the Colleges and Schools

(See Footnotes 6, 7, 8, 9, 10)

College or School	Full Time	
	Resident	Nonresident
<i>GROUP I</i>		
Agriculture and Forestry	\$90.00* plus Registration Fee of \$50.00.	\$255.00* plus Registration Fee of \$200.00.
Art and Sciences		
Commerce		
Creative Arts Center		
(Music, Art, Drama)		
Engineering		
Human Resources and Education		
Journalism		
Mines		
Physical Education		
<i>GROUP II</i>		
Dental Hygiene	\$105.00* plus Registration Fee of \$50.00.	\$280.00* plus Registration Fee of \$200.00.
Law		
Medical Technology (Jr. and Sr. Years)		
Nursing		
Pharmacy		
<i>GROUP III</i>		
Dentistry	\$167.00* plus Registration Fee of \$50.00.	\$385.00* plus Registration Fee of \$200.00.
Medicine		

Part Time

Tuition, per semester hour	Resident	Nonresident
Undergraduate students	\$ 9.00**	\$33.00***
Graduate and professional students (Dentistry, Law, Medicine)	14.00**	38.00***

*Includes Athletics Fee \$8.25; Student Educational Services Fee \$4.00; Daily Athenaeum \$1.50; Health, Counseling Service and Program Fee \$12.00; Student Union Fee \$20.00; University Fee \$4.25.

**Includes \$4.00 per semester hour Registration Fee.

***Includes \$16.00 per semester hour Registration Fee.
Parkersburg Center of West Virginia University \$15.00 per semester hour for resident students; \$17.00 per semester hour for nonresident students.

Kanawha Valley Graduate Center (Nitro, W. Va.): \$14.00 per semester hour for resident students; \$38.00 per semester hour for nonresident students.

Undergraduate and Graduate Music Students

Full-time or part-time students registered for Bachelors' or advanced degrees in Music or the Supervisory Training Program in Music shall pay the regular full-time or part-time fees for all courses in music. No additional fees are assessed for Applied Music.

¹This fee is not charged to full-time students who complete registration during the regular registration days as set forth in the University Calendar. This fee is not charged to part-time students who complete registration by the close of office hours on the eighth day following the beginning of General Registration.

²The Graduation Fee is payable by all students at the beginning of the semester or session in which they expect to receive their degrees.

³One transcript of a student's record is furnished by the Registrar without charge. This fee is charged for furnishing an additional transcript.

⁴If the applicant applies for admission to and registers in the University within twelve months of the date for his qualifying for the test, a \$10.00 credit shall be established for him.

⁵For graduate students not otherwise enrolled at time of final examination.

Students registered in other colleges or schools, including the Graduate School, may enroll in class courses in music at the regular full-time rate or part-time fee per credit hour. These students may also enroll for Applied Music for a maximum of one half-hour lesson per week for one hour credit. The fee for this Applied Music instruction shall be \$20.00 in addition to the aforementioned tuition and registration fee. See the University *Undergraduate Catalog* for additional details on fees.

Summer Session Fees

Tuition, per semester hour	Resident	Nonresident
Undergraduate students	\$ 9.00*	\$33.00**
Graduate and professional students		
(Dentistry, Law, Medicine)	14.00*	38.00**
Daily Athenaeum Fee††	1.00	1.00
Health and Counseling Service Fee†	7.00	7.00
Student Union Fee per summer term		
in excess of five weeks††	12.00	12.00
Student Union Fee per five-week summer term		
or any portion thereof††	6.00	6.00
Student Educational Services Fee†	2.00	2.00
University Fee†	2.00	2.00

*Includes \$4.00 per semester hour Registration Fee.

**Includes \$16.00 per semester hour Registration Fee.

†Nonrefundable fees required of full-time students. May be paid by part-time students who desire the services. Part-time students who elect to pay these fees must pay the same amount assessed full-time students.

††Fee required of all students. (Nonrefundable unless student withdraws officially before the close of general registration).

Auditors

Students may enroll in courses without working for grade or for credit by registering as auditors and by paying full fees. Change in status from audit to credit or from credit to audit may be made during the registration period. Attendance requirements for auditors shall be determined by the instructor of the course being audited. It is the prerogative of the instructor to strike the name of any auditor from grade report forms and to instruct the registrar to withdraw the auditor from the class, if he should fail to meet such attendance requirements.

Remission of Fees

The tuition fee and registration fee will be remitted to a person registered in the Graduate School or the College of Law and who is employed by the University on a regular appointment approved by the Board of Governors, subject to the following:

^aA full-time graduate student is one who is registered for 9 or more semester hours of work each semester of the regular academic year, 6 or more semester hours of work during the 10-week Summer Session, or 3 semester hours of work during a 5-week Summer Term. A full-time student during the regular academic year receives an Identification Card which entitles him to admission to all athletic events. A full-time student during the regular academic year or during the Summer Session is entitled to free medical consultation and advice from the University physician. A moderate charge is made for room calls, X-rays, special laboratory tests, drugs furnished by the University Pharmacy, minor operations, treatment of fractures and dislocations, and intravenous treatment.

⁷A part-time graduate student is one who is registered for fewer than 9 semester hours per semester during the regular academic year, or for fewer than 6 semester hours during the 10-week Summer Session, or for fewer than 3 semester hours during a 5-week Summer Term.

⁸No person shall be considered eligible to register in the University as a resident student who has not been domiciled in the State of West Virginia for at least twelve consecutive months next preceding college registration. No nonresident student may establish domicile in this State, entitling him to reduction or exemptions of tuition, merely by his attendance as a full-time student at any institution of learning in the State. A minor student whose parents acquire a West Virginia domicile after the student's original registration will be deemed to have the domicile of his parents and become entitled to pay resident fees. Moreover any student who has originally paid nonresident fees may become entitled to pay resident fees, if after an interim of nonattendance or otherwise he has established a valid legal domicile in this State at least twelve months prior to his registration in the University. In any event, the appointment of a guardian for a minor student temporarily resident in West Virginia, other than the designation of a natural guardian, shall not in and of itself operate to establish a West Virginia domicile for such student.

⁹The minimum rate for non-credit courses is that charged for one semester hour or credit.

¹⁰Tuition, Registration Fee, Athletics Fee, Student Educational Services Fee, Health, Counseling Service, and Program Fee, and University Fee. The Student Union Fee and Daily Athenaeum Fee are nonrefundable after the eighteenth day following the beginning of General Registration.

(a) There will be no remission of the Daily Athenaeum fee or of the Student Union fee. These fees are charged all students, full-time and part-time, who are enrolled for regular courses or resident instruction.

(b) Except as provided in "c", a graduate teaching or graduate research assistant will receive remission of tuition fee and registration fee commensurate with the hours of service required by the terms of his appointment.

(c) A faculty member on full-time appointment at any recognized institution of higher learning located in West Virginia who is taking a course of graduate study at the University and holds an appointment as a graduate assistant under the terms of Order No. 3071 of the Board of Governors will receive full remission of tuition fee and registration fee.

(d) A regular appointment must be effective at the beginning of a semester or summer session. Exemption from tuition fee and registration fee must be claimed at the beginning of the registration period or, in the case of a substitute appointment, within ten days after the appointment has been made.

(e) An employee who holds a regular appointment and is eligible for remission of tuition fee and registration fee in the second semester of any regular academic year is also eligible for remission of tuition fee and registration fee in the summer session immediately following his term of appointment.

In certain cases an employee on regular University appointment approved by the Board of Governors, may be permitted to register as a full-time student in the Graduate School or the College of Law. If such an employee does register as a full-time student and qualifies for remission of tuition fee and registration fee, he shall not be subject to the Special Services fees, except the Daily Athenaeum fee and the Student Union fee, but must pay such fees to be entitled to the services provided thereby. Such employees do not receive the Student Identification Card which provides for athletic admissions, student educational services, health and counseling service, etc.

The spouse and dependent children of any person employed full-time by the Board of Governors of West Virginia University shall be charged the same fees as resident students provided the employee is living in West Virginia. The spouse and dependent children of full-time interns, residents, and fellows in the School of Medicine, School of Dentistry, and University Hospital programs shall also be charged the same fee as resident students.

Refunding of Fees

A student who officially withdraws from University courses may arrange for a refund of fees by submitting to the University Comptroller evidence of eligibility for a refund.

To withdraw officially from the University a student must apply to the Registrar for permission. Semester fees will be returned in accordance with the following schedule:

First refund period ending on the eighteenth day following the beginning of General Registration	}	All Activity fees chargeable to Special Services and all other semester fees less \$2.50. (Under no circumstances is the amount retained less than \$2.50.)
Second refund period ending on the fifth Friday following the beginning of General Registration.		70% of all refundable fees ^o
Last refund period ending on the eighth Friday following the beginning of General Registration	}	40% of all refundable fees ^o

The second Friday following the beginning of General Registration for a summer session or a summer term is the end of the refund period.

No part of the Activity Fee is refundable unless the student withdraws from the University.

The University Board of Governors has ordered that students called to the armed services of the United States be granted full refund of refundable fees, but no credit, if the call comes before the end of the first three-fourths of the term, and that full credit by courses be granted to men called to the armed services of the United States if the call comes thereafter; provided, however, that credit as described above will be granted only in those courses in which the student is maintaining a passing mark at the time of his departure for military service. In the recording of final grades, for three-fourths of a term or more, both passing and failing grades are to be shown on the student's permanent record card.

Service Charge on Returned Checks

A service charge of 5 per cent of the amount of each check returned unpaid by the bank upon which it is drawn shall be collected unless the student can obtain an admission of error from the bank.

If the check returned by the bank was in payment of University and registration fees, the Comptroller's office shall declare the fees unpaid and registration cancelled if the check has not been redeemed within three days from date of written notice. In such a case the student may be reinstated upon redemption of the check, payment of the 5 per cent service charge, and payment of a late payment fee of \$10.00.

Part IV / Courses of Study

ABBREVIATIONS

- I—a course given in the first semester.
- II—a course given in the second semester.
- I, II—a semester course given in each semester.
- I and II—a course given throughout the year.
- S—a course given in the Summer Session.
- hr.—number of credit hours per course.
- rec.—recitation period.
- lab.—laboratory period.
- conc.—concurrent registration required.
- PR.—prerequisite.
- consent—consent of instructor required.

NOTE: Summer courses carry the same credit value as courses offered in the regular semesters.

PLAN FOR NUMBERING COURSES

Courses 200 to 299—Course open to graduate and upper-division undergraduate students.

Courses 300 to 399—Courses open to graduate students only.

AGRICULTURE AND FORESTRY

AGRICULTURE

The Degree of Master of Agriculture

In general, the requirements for and the regulations governing the granting of this degree are the same as those for the Master of Science. A minimum total number of 30 credit hours, including the three for the problem report, is required. Specific requirements for the degree of Master of Agriculture are:

1. Candidates for the degree of Master of Agriculture shall have previously completed requirements for the degree of Bachelor of Science in Agriculture or its equivalent.

2. A problem report (rather than a research thesis) on some phase of agriculture shall be required. A maximum of 3 semester hours of credit may be allowed for the problem report, which must be approved by the student's committee. The candidate must submit an outline for his problem report to his committee prior to the completion of the first 12 hours of credit applicable to this degree.

3. The program of work shall be such that emphasis will be on breadth of knowledge in the field of agriculture rather than upon one narrow field of science. To insure such breadth of training, the student must take at least three credit hours of work in at least four subject-matter groups within the Division of Agriculture.

A maximum of 12 credit hours exclusive of the problem report, will be accepted in any subject-matter group or administrative department. The subject-matter groups from which the student may select courses are:

1. Agricultural Economics, Agricultural Education
2. Agricultural Mechanics
3. Animal Science
4. Bacteriology, Entomology
5. Agricultural Biochemistry, Genetics
6. Food Science
7. Landscape Architecture
8. Plant Sciences (Agronomy, Horticulture, and Plant Pathology)
9. Soil Science

A maximum of 10 credit hours taken in other divisions of the College of Agriculture and Forestry or in other colleges of the University may apply toward meeting the total credit-hour requirement.

Agriculture

200. **Agricultural Travel Course.** S. 6 hr. Tour and study of production methods in major livestock and crop regions of the United States and other countries. Influence of population, climate, soil, topography, markets, labor, and other factors on agricultural production.
360. **Problem Report for the Degree of Master of Agriculture.** I, II, S. 1-3 hr.

AGRICULTURAL BIOCHEMISTRY

The Faculty of Agricultural Biochemistry, an interdepartmental faculty group within the Division of Agriculture, is responsible for the planning and conduct of course offerings in Agricultural Biochemistry and the graduate degree programs in Agricultural Biochemistry.

In addition to meeting the requirements for admission to the Graduate School, applicants for admission to the graduate degree programs in Agricultural Biochemistry must have at least a grade-point average of 2.5 in the following courses: general, analytical, organic, and physical chemistry. An applicant who does not present all the chemistry requirements may be admitted provided the Faculty of Agricultural Biochemistry feels that existing deficiencies in chemistry may be removed within one year.

The Degree of Master of Science

Work for the degree of Master of Science consists chiefly of course offerings selected according to the special needs of the student from 200 and 300 courses in agricultural biochemistry, medical biochemistry, chemistry, statistics, and the biological sciences. A total of no fewer than 30 hours of graduate credit is required of which no more than 6 may be for research. A thesis is required.

The Degree of Doctor of Philosophy

Applicants for the degree of Doctor of Philosophy must pass comprehensive written and oral examinations in biochemistry and one or two minor fields. The applicant does not become a candidate for the degree until he has successfully passed the language examinations and the comprehensive examination.

Agricultural Biochemistry

214. **Radionuclide Biochemistry.** I. 3 hr. PR: Chem. 1, 2, 131, or consent. Radionuclide methods and isotope handling as needed by students interested in biological research. Offered in Fall of even years.
290. **General Biochemistry.** I. 3 hr. PR: Organic Chem. 8 hr., quantitative analysis and consent. A general course in biochemistry primarily intended to meet the needs of graduate students.

291. **General Biochemistry.** II. 3 hr. PR: Agr. Biochem. 290 or consent. A continuation of Agr. Biochem. 290.
292. **Animal Biochemistry.** I. 2 hr. PR or conc: Agr. Biochem. 291. Nutritional and physiological chemistry of domestic animals.
293. **Laboratory Experiments in Biochemistry.** I. 2 hr. PR or conc: Agr. Biochem. 290. Experiments to demonstrate certain phases of the subject matter covered in General Biochemistry.
301. **Enzymes.** II. 3 hr. PR: Agr. Biochem. 290 or consent. A general survey of the chemistry enzymes for the advanced student.
303. **Biochemistry of Carbohydrates.** II. 3 hr. PR: Agr. Biochem. 291. The structure, properties and metabolism of sugar and polysaccharides.
305. **Lipid Biochemistry.** I. 3 hr. PR: Agr. Biochem. 290, 291, and consent. A consideration of the chemical and physical properties of the various classes of lipids and their biochemical and physiological pathways within the cell and cellular particulates.
308. **Vitamins.** I. 2 hr. PR: Biochem. 101, 290, and 291 or consent. Identification, nomenclature and chemical structures, biochemical systems, biogenesis, pathology and requirements of vitamins and vitamin like compounds. Offered in Fall of odd years.
320. **Special Topics.** I, II, S. 2-4 hr. Advanced training will be provided through literature surveys and special research projects, in such areas as biochemical techniques, animal nutrition and metabolism.
325. **Plant Biochemistry.** I. 3 hr. PR: Agr. Biochem. 291 or equiv. An advanced treatment of the composition and metabolism of plants.
330. **Mineral Metabolism.** I. 3 hr. PR: Chem. 1, 2, 31; Biochem. 290-291, or consent. The inorganic and biochemistry of the minerals in the body and the physiological function of minerals are studied. A special term paper is required of each student on the chemical metabolism studies. Offered in Fall of even years.
350. **Seminar.** I, II. 1 hr. per sem.
397. **Research.** I, II, S. 1-15 hr. per sem.

AGRICULTURAL ECONOMICS

The Department offers major work for the degree of Master of Science in Agricultural Economics. Economics and Agricultural Economics faculties cooperate in offering a Ph.D., Degree. For details on this degree, see the College of Commerce section. Students are urged to seek approval from the Department Admissions Committee of one of the options listed below at the time they begin work. In all cases, approval must be obtained before completion of 18 hours of course work. Students expecting to become professional agricultural economists should seek approval of Option A. Those intending to pursue careers in agricultural business may wish to seek approval of Option B.

Requirements for Admission

Students may be accepted for graduate study in Agricultural Economics on a regular or probationary basis. Students meeting all of the following requirements are admitted as regular students:

1. A bachelor's degree.
2. Twelve or more semester credits in economics, agricultural economics, statistics, or appropriate social science courses.
3. A grade-point average of 2.5 for all college or university credit and for all credit in economics and agricultural economics.

Students not meeting the above minimum requirements may petition for admission on a probationary basis. The Department Admissions Committee will set requirements for removing probationary status in each case. Failure of a student to fulfill the terms of his probation shall result in automatic suspension.

Students requesting transfer of graduate credit from courses outside the Department must obtain approval of the Department Admissions Committee for such transfer and the average for such courses transferred must be no less than 2.5. Such petitions must include all courses appropriate to the degree; courses with low grades will not be omitted.

Options of Study

A. Thesis Option — A minimum of 30 credit hours of approved work to include not more than 6 hours of credit for the thesis, and enough courses to provide proficiency in economics and agricultural economics. Courses in closely related social sciences may be included.

B. Course-Work Option — A minimum of 36 credit hours of approved course work to provide proficiency in economics and agricultural economics. Courses in closely related social sciences may be included.

Standards of Achievement

A minimum grade-point average of 3.0 is required for all graduate credit courses taken as part of the approved program for this degree. This includes graduate credit transferred from within the University and graduate credit accumulated while pursuing a degree in Agricultural Economics.

Students who have earned a grade-point average of 2.75 or more with 12 or more hours of graduate credit will be admitted to candidacy. Those who do not attain this level will be placed on probation.

Examinations

Thesis Option. Satisfactory completion of an oral examination and, at the discretion of the student's graduate committee, a written examination.

Course-Work Option. Satisfactory completion of a written and an oral examination.

Agricultural Economics*

- 200. **Land Economics. II.** 3 hr. Classification, development, tenure, use, conservation, valuation and taxation, of rural, urban, mineral, forest, water, and recreational land resources.
- 206. **Farm Planning. I.** 3 hr. Principal factors influencing returns on farms; planning use of labor, soil, crops, livestock, buildings and equipment. Farm visits required.
- 213. **Economic Development. I or II.** 3 hr. A comprehensive study of the problems, changes, and principal policy issues faced by non-industrialized countries in the process of economic development. This is a dual listing with Economics 213. Students who elect Agr. Econ. 213 may not receive additional credit for Economics 213.
- 230. **Cooperative Organization. II.** 2-3 hr. Organization, functions, and contributions of cooperatives in an economic system. Offered in Spring of even years.
- 235. **Marketing Dairy Products. II.** 2 hr. Milk marketing policies and practices, including milk-market order. Offered in Spring of odd years.

*Economics 52 or equivalent is required as a prerequisite for all graduate courses offered by the Department of Agricultural Economics.

240. **Agricultural Prices. II.** 3 hr. An analysis of the price-making forces which operate in the market places for the major agricultural commodities.
255. **Resource Analysis in Agribusiness and Forestry. I.** 3 hr. A study of the factors of land, labor, capital and management available on farms, in forests and in agribusiness, the transformation rates from resources into products, and the utilization of economic models consistent with reality, so as to allocate the resources among feasible alternatives into profit maximizing plans with the assistance of electronic equipment.
261. **Agribusiness Finance. I.** 3 hr. Credit needs of agricultural business; financing farm and market-agency firms; and organization and operation of credit agencies which finance agricultural business firms. Offered in Fall of odd years.
271. **Agricultural Policy. II.** 3 hr. An examination of the economic aspects of government price program, production and marketing controls, subsidies, parity, export and import policies, and other programs affecting agriculture. Offered in Spring of even years.
320. **Special Topics. I, II, S.** 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.)
340. **Advanced Farm Management. I.** 3 hr. Offered in Fall of odd years.
341. **Production Economics. II.** 3 hr. PR: Consent. Economic principles of production with special application to agriculture. Offered in Spring of odd years.
342. **Advanced Agricultural Economics. II.** 3 hr.
397. **Research. I and II.** 1-15 hr. per sem.

AGRICULTURAL EDUCATION

Candidates for the Master of Science degree with a major in Agricultural Education must have done satisfactory work as undergraduates. The student's candidacy must be approved by the chairman of the department. Candidates for the master's degree in agricultural education must have fulfilled the requirements for B.S. Agr. at West Virginia University or at an approved institution offering an equivalent degree. Also, the candidate must have completed a minimum of 20 hours in education and 45 hours in agriculture.

Students shall combine graduate courses in agriculture and in education by taking 16 to 20 hours in agriculture and 10 to 14 hours in education. A minimum of 5 hours shall be in professional courses dealing with agricultural education. All graduate courses offered toward a degree must have prior approval of the adviser. The student and the adviser shall arrange a specific curriculum to be pursued for the degree at the beginning of the graduate program. A thesis or problem is required as a part of the 30 hours for graduation.

Students shall complete in residence 15 hours of course work after having completed one or more years of teaching vocational agriculture. This shall apply unless the student has been granted permission by the Department to complete his graduate work without teaching experience.

Education

- Ed. 276. **Teaching Young, Adult Farmer, and Off-Farm Agricultural Occupations Classes. I, S.** 2 hr. PR: Ed. 105, 106, or consent. Participation in conducting young, adult farmer, and off-farm agricultural occupations classes; organization, course of instruction, method of teaching and supervision of the classes, young farmers' associations, adult farmers' organizations in classes.
- Ed. 277. **Organizing and Directing Supervised Farming and Supervised Occupational Experience Programs. I, S.** 2 hr. PR: Ed. 160 or consent. Planning programs of supervised farming and supervised occupational experience, supervising and evaluating such programs for day students, young, adult farmer, and off-farm agricultural occupations classes and groups.

- Ed. 318. **Planning Programs and Courses for Vocational Agriculture Departments.** S. 2 hr. PR: Ed: 124 160. Gathering data, studying the farming and off-farm agricultural occupations problems of day students, young famers, adult farmers, and off-farm agricultural occupations groups and formulating total programs for school communities.

Agricultural Education

234. **Principles of Cooperative Extension. I.** 2 hr. Background, philosophy, and history of cooperative extension. Activities of county cooperative extension agents and cooperative extension programs in West Virginia.
238. **Method and Materials in Extension Education. II.** 2 hr. Organization and preparation for extension teaching and the processes of communication.
239. **Program Building in Cooperative Extension. II.** 3 hr. PR: Agr. Educ. 234, 238, or consent. Organization in relation to program building. Leadership and group action. Over-all working and educational objectives, principles, method, and goals in developing cooperative extension programs.
320. **Special Topics. I, II, S.** 1-4 hr. (For the Master's Degree, Special Topics ordinarily may count for 2 to 4 hr.; maximum credit, 6 hr.).
350. **Seminar. S.** 1 hr.
360. **Problem. I, II, S.** 1-3 hr. (For the Master's Degree).
397. **Research. I, II, S.** 1-15 hr.

AGRICULTURAL MECHANICS

Graduate study in Agricultural Mechanics is offered as a minor for Master of Science candidates majoring in other fields and to candidates seeking the Master of Agriculture Degree.

252. **Advanced Farm Mechanics. II.** 3 hr. PR: Agr. Mech. 152. Forging, cold-iron work, tool fitting, woodworking. Offers training for teaching shop work in rural high schools. 1 hr. rec., 6 hr. lab.
253. **Advanced Farm Machinery. II.** 3 hr. Performance of agricultural equipment including calibration, efficiency, adjustments, and maintenance. Theoretical and practical aspects of selection based on economics, compatability of machines with other equipment and the farming operation, service, and factors of custom operation. 2 hr. rec., 3 hr. lab.
259. **Farm Structures. II.** 3 hr. Fundamentals of construction, functional requirements, materials, new equipment, and use of laborsaving ideas and machinery. 2 hr. rec., 3 hr. lab.
270. **Electricity in Agriculture. II.** 3 hr. The study of the fundamentals of electrical energy and its application to lighting power, heating, and control circuits used in agriculture. 2 hr. rec., 3 hr. lab.
275. **Agricultural Engines. I.** 3 hr. Relation of theory to design and operation of internal combustion engines with emphasis on care, operation, and maintenance. Study covers one, two, three, four, six, and eight cylinder engines, both in two and four stroke designs. 2 hr. rec., 3 hr. lab.
320. **Special Topics. I, II, S.** 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.).
397. **Research. I and II, S.** 1-15 hr.

AGRONOMY AND GENETICS

The Department of Agronomy and Genetics offers the degree of Master of Science and Doctor of Philosophy with majors in crops, soils, and genetics.

Adequately equipped laboratories, greenhouse, and growth chambers are available. Several experimental farms are available for field investigations.

To enter graduate work, the student must have adequate background in the physical and biological sciences in addition to basic courses in crop science, genetics, or soil science. Students who have not had these basic courses will be required to take them without credit early in their graduate program. In addition to courses in their major field of study, students will be expected to study in one or more related fields with the course selection dependent upon the field of interest.

The course schedule for graduate study will be developed in consultation with the student's adviser and will include certain designated requirements for each curriculum.

A thesis or problem report and a final examination are required for the Master of Science degree. Requirements for the Doctor of Philosophy degree are as outlined by the Graduate School.

Agronomy (Crop Science)

- 250. **Turfgrass Management.** I. 3 hr. PR: Agron. 2, or consent. The establishment, maintenance, and adaptation of grasses and legumes for lawns, golf courses, parks, athletic fields and roadsides. An understanding of turfgrass management will be developed by associating differential plant responses with soil, climatic, and biotic factors that influence plant species growth, selection, and adaptation. Offered in Fall of even years.
- 251. **Weed Control.** I. 3 hr. PR: Agr. 52 and Agron. 2 or consent. Fundamental principles of weed control. Recommended control measures for and identification of common weeds. 2 lec., 1 lab. Offered in Fall of odd years.
- 252. **Grain and Special Crops.** II. 3 hr. PR: Agr. 52 and Agron. 2 or consent. Advanced study of methods in the production of grain and special crops. Varieties, improvement, tillage, harvesting, storage, and uses of crops grown for seed, or special purposes. Offered in Fall of even years.
- 254. **Pasture and Forage Crops.** II. 4 hr. PR: Agr. 52 and Agron. 2 or consent. All phases of pasture and forage crop production, including identification, seeding, management, use, seed production, and storage of forage crops. 3 lec., 1 lab.

Agronomy (Soil Science)

- 210. **Soil Fertility.** I. 3 hr. PR: Agron. 2 or 10. Soil properties in relation to fertility and productivity of soils; evaluation of soil fertility; production of fertilizers and their use in increasing the fertility and productivity of soils.
- 212. **Soil Conservation and Management.** II. 3 hr. PR: Agron. 2 or 10. Using soil technology to solve soil management problems relating to cropping systems. Field diagnosis of soil problems will be stressed. Two half-day visits. Offered in Spring of odd years.
- 216. **Soil Genesis and Classification.** I. 3 hr. PR: Agron. 2 or 10. Origin and formation of soils. Study of soil profiles and soil forming processes in the field and laboratory. Principles of classification and techniques of soil mapping. 2 lec., 1 lab. Offered in Fall of even years.
- 230. **Soil Physics.** II. 3 hr. PR: Agron. 2 or 10. Physical properties of soils, water and air relationships and their influence on soil productivity. Offered in Spring of even years, 2 lec., 1 lab.
- 301. **Geotechnic.** I. 3 hr. PR: Consent. A presentation of a unified approach to the various aspects of soil formation and the influence of the formative factors

on the nature of soils and their use as engineering materials. This course will serve as a common meeting ground for students in the various disciplines concerned with earth science. 3 lec. Offered in the Fall of odd years.

- 310. **Advanced Soil Fertility.** II. 3 hr. PR: Agron. 210, Bot. 171 or consent. The influence of soil chemical and physical properties or availability of plant nutrients, intensive study of individual plant nutrients; and interactions of nutrients in soils and crops. Offered in spring of odd years.
- 316. **Soil Chemistry.** I. 3 hr. PR: Consent. Chemistry of soil development; chemical and mineralogical composition of soils; nature and properties of organic and inorganic soil colloids; soil acidity; cation and anion exchange phenomena; soil chemistry of macro- and micronutrients.
- 318. **Chemistry of Soil Organic Matter.** II. 3 hr. PR: Agron. 210 or consent. The chemical composition of soil organic matter will be studied in relation to its physico-chemical properties and human formation. Methods involving extraction. Fractionation and purification of soil organic components will be examined. 2 lec., 1 lab. Offered in spring of even years.

Agronomy (Crop and Soil Science)

- 320. **Special Topics.** I, II, S. 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.).
- 350. **Seminar.** I, II. 1 hr. per sem. Recent literature pertaining to soil and crop production.
- 397. **Research.** I, II. 1-15 hr. per sem.

Genetics

- 220. **Crop Breeding.** II. 3 hr. PR: Gen. 171 or 221. Methods and basic scientific principles involved in the improvement of leading cereal and forage crops through hybridization and selections. Offered in Spring of odd years.
- 221. **Basic Concepts of Modern Genetics.** I. 3 hr. PR: 8 hr. of biological science and 1 year of chemistry. Independent inheritance, linkage. Chemical nature of genetic material. Control of phenotype by genetic material. Gene action and coding of genetic material.
- 224. **Human Genetics.** II. 3 hr. PR: Gen. 171 or 221 or consent. A study of the genetic system responsible for the development of phenotype in man. Offered in Spring of even years.
- 320. **Special Topics.** I, II, S. 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.).
- 324. **Cytogenetics.** II. 4 hr. PR: Gen. 171 or 221, and Biol. 215 or consent. Emphasis is put upon macromolecules that carry information of the chromosomes, cell division and the cytological and molecular basis of genetics. Special attention is given to cytogenetics of genomes and chromosome morphology and the evolution of these. Offered in Spring of odd years.
- 326. **Advanced Physiological Genetics.** II. 3 hr. PR: Gen. 171 or 211 and Organic Chem. Physiological and biophysical concepts of genetic material. Structure and arrangement of genetic units. Nucleic acids as carriers of genetic information. Gene action and amino acid coding. Biochemical evolution of genetic material. Offered in Spring of even years.
- 335. **Population Genetics.** I. 3 hr. PR: Gen. 171 or 221, or consent. The relationship of gene and genotype frequencies in populations of diploid organisms, and the effects of mutation, migration, selection, assortive mating, and inbreeding, in relation to single gene pairs. Application of these concepts to the multigenic inheritance of quantitative traits. Offered in Fall of even years.
- 350. **Seminar.** I, II. 1 hr. per sem. Recent literature pertaining to breeding, genetics, and cytology.

390. **Genetic Mechanisms of Evolution.** II. 2 hr. PR: Gen. 171 or equiv. The genetic mechanisms which result in evolutionary change. The origin of life, origin and organization of genetic variability, differentiation of populations, isolation and speciation role of hybridization and polyploidy, origin of man. Offered in Spring of even years.
397. **Research.** I, II. 1-15 hr. per sem.

Bacteriology

314. **Soil Microbiology.** II. 4 hr. PR: Bact. 141 and organic chemistry. Occurrence and distribution of microorganisms in soils and their interrelationships. Their role in decomposition of organic matter and other transformations of soil constituents. Offered in Spring of odd years.

ANIMAL INDUSTRY AND VETERINARY SCIENCE

The department offers Master of Science programs in two areas, Animal Science and Animal Nutrition, and a Doctor of Philosophy program in Animal Nutrition. The department participates in interdepartmental programs in Agricultural Biochemistry, Genetics, and Reproductive Physiology which offer both the Master of Science and the Doctor of Philosophy.

The Master of Science program in Animal Science allows maximum flexibility in courses and research problems. Students may work with beef and dairy cattle, sheep, swine, poultry, rats, mice and meadow voles. They may emphasize physiology, pathology, production, breeding, nutrition or food products. Research problems in farm animals form the basis for many studies, but the comparative approach is emphasized.

Admission requirements are similar to those in other biological sciences. The student should have completed basic courses in the physical and biological sciences, including genetics, nutrition and physiology. For the programs in Animal Nutrition, analytical chemistry and organic chemistry (one year) are required. Deficiencies may prolong the time needed to complete degree programs.

Twenty-four approved hours of course work and a thesis are required for all Master of Science degrees. The doctoral programs are governed by the general regulations of the Graduate School.

Animal Industry and Veterinary Science

320. **Special Topics.** I, II, S. 1-4 hr. (1 hr. credit in special cases only). Advanced study in particular phases of such animal industry topics as animal production, nutrition, physiology, breeding and genetics, veterinary science, and food science. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.).
370. **Methods of Animal Research.** I. 3 hr. Design, experimental procedures, and analyses used in research in the several areas of animal science. Offered in odd years.

Animal Breeding and Genetics

212. **Poultry Breeding.** II. 3 hr. PR: Course in Genetics or consent. Breeding techniques specific for genetic improvement of economic traits in poultry.
226. **Breeding of Farm Animals.** I. 3 hr. PR: Course in Genetics or consent. Application of principles of quantitative genetics to the improvement of farm animals.
326. **Advanced Animal Selection.** II. 3 hr. PR: Course in Statistics and course in Genetics or equiv. An advanced course dealing with the basic concepts of experimental and statistical approaches in the analysis of quantitative inheritance with special reference to the magnitude and nature of genotypic and non-genotypic variability. Offered in even years.

350. **Seminar.** I, II. 1 hr. per sem.
397. **Research.** I, II, S. 1-15 hr. per sem. For graduate students working on a problem in preparation of a thesis.

Animal Nutrition

294. **Poultry Nutrition.** II. 3 hr. PR: An Nutr. 101 Nutritional requirements, nutrient interrelationships and nutritional deficiencies of all types of domesticated fowl.
295. **Principles of Nutrition and Metabolism.** I. 3 hr. PR: Agr. Biochem. 101, An. Physiol. 100, or equiv. A basic course in animal nutrition.
305. **Comparative Nutrition and Metabolism.** II. 3 hr. PR: An. Nutr. 295 or consent. A comparative study of the utilization of dietary nutrients by species of laboratory and domestic animals and man. Offered in odd years.
306. **Nutrition Laboratory Methods.** I. 3 hr. PR: An. Nutr. 295 or concurrent registration. Chemical, physical, and biological methods used in animal nutrition research. Offered in odd years.
308. **Advanced Nutrition and Metabolism.** I. 3 hr. PR: Agr. Biochem. 291 or consent. Advanced treatment of the nutrition, metabolism, nutrient interrelationship and metabolic regulatory mechanisms of domestic animals.
310. **Nutrition and Physiology of the Ruminant.** II. 3 hr. PR: Physiol. 100; An. Nutr. 101; Agr. Biochem. 290. A study of the nutritional and physiological processes peculiar to the ruminant animal. Offered in even years.
311. **Problems in Nutritional Physiology.** I. 3 hr. PR: An. Nutr. 305 or consent. Consideration of the interrelation of nutrition with growth, reproduction, environment, disease and related areas. Offered in odd years.
350. **Seminar.** I, II. 1 hr.
397. **Research.** I, II, S. 1-15 hr. per sem. For graduate students working on a problem in preparation of a thesis.

Animal Physiology

204. **Animal Physiology Laboratory.** I. 2 hr. PR: An. Physiol. 100 or concurrent registration. Laboratory study of the physiological systems of animals and the influences of environment on these systems.
225. **Physiology of Reproduction.** II. 3 hr. PR: Course in Biology. Comparative physiology of reproduction in higher animals; endocrine functions involved in reproduction; genetic and environmental variations in fertility mechanisms.
227. **Milk Secretion.** II. 3 hr. (1 lab.). PR: Course in An. Physiol. The evolution, anatomy, and growth of the mammary gland. The chemical, hormonal, physiological and environmental factors affecting lactation. Offered in odd years.
280. **Behavioral Patterns of Domestic Animals.** II. 3 hr. Examination of the bases for, and exhibition and control of behavioral patterns of domestic animals.
335. **Endocrinology of Reproduction.** II. 4 hr. (2 labs.). PR: An. Physiol. 225 or Zool. 272 or equiv. Discussion of and laboratory experience in classical current concepts of hormonal and neurohormonal regulation of reproductive phenomena with emphasis on species differences and similarities.
350. **Seminar.** I, II. 1 hr.
397. **Research.** I, II, S. 1-15 hr. per sem. For graduate students working on a problem in preparation of a thesis.

NOTE: Students are also referred to Psych. 201, Physiological Psychology; Zool. 171, Human Physiology; Zool. 273, 274, Cellular Physiology; and Zool. 276, Comparative Physiology.

Animal Production

- 201. **Advanced Poultry Production. I.** 3 hr. PR: Course in Nutrition. Special phases of broiler and egg production, disease control, laborsaving studies, recent designs in building and heating equipment for all types of poultry. Offered in even years.
- 223. **Advanced Animal Production. I.** 3 hr. PR: An. Nutr. 101. Application of breeding, physiology, and nutrition to problems in meat animal production.
- 224. **Current Literature in Animal Science. II.** 3 hr. PR: An. Nutr. 101. Evaluation of current research in animal science and its application to production and management.
- 330. **Advanced Milk Production. II.** 3 hr. PR: An. Nutr. 101 or consent. Advanced study of the feeding, breeding, and management of dairy cattle. Offered in odd years.
- 350. **Seminar. I, II.** 1 hr.
- 397. **Research. I, II, S.** 1-15 hr. per sem. For graduate students working on a problem in preparation of a thesis.

Food Science

- *202. **Advanced Meats. II.** 3 hr. (2 labs.). PR: Food Sci. 167. Studies covering composition of meat, complete fabrication of meat animal carcasses, factors influencing yield, physiology and chemistry of pertinent phenomena, and merchandising of meat. Offered in even years.
- 312. **Critical Evaluation of Recent Research and Developments in Dairy Foods. I.** 4 hr. (2 labs.). PR: Consent. Normally a minimum of Bact. 246 and at least one Dairy Foods course will be required. Methods, results and impact of recent research and developments pertaining to dairy food industry. Offered in even years.
- 350. **Seminar. I, II.** 1 hr.
- 397. **Research. I, II, S.** 1-15 hr. per sem. For graduate students working on a problem in preparation of a thesis.

Veterinary Science

- 205. **Parasites and Pathology. II.** 3 hr. PR: Course in Biology. Common parasites of farm animals, their control, and their effect upon the host. Offered in odd years.
- 210. **Principles of Laboratory Animal Science. II.** 3 hr. (1 lab.). PR: Consent for undergraduates. The management, genetics, physiology, nutrition, disease, and germ free quartering of the common laboratory animals.
- 350. **Seminar. I, II.** 1 hr.
- 397. **Research. I, II, S.** 1-15 hr. per sem. For graduate students working on a problem in preparation of a thesis.

HORTICULTURE

The Department of Horticulture offers a Master of Science program in the various aspects of Horticulture and a Doctor of Philosophy program in Plant Physiology. To enter graduate work the student should have basic courses in the physiological and biological sciences in addition to basic courses in Genetics, Soils, and Plant Physiology. Students who have not had such courses will be required to take these early in their graduate work.

*Transportation for required trips in connection with this course will generally be supplied by the College. Students will be responsible for their meals and lodging.

The candidate for the degree of Master of Science should offer a minimum of 30 semester hours properly distributed among the related sciences and his major field. The doctoral program is covered by the general regulations of the Graduate School and the faculty of Plant Physiology.

Horticulture

- 204. **Plant Propagation.** II. 3 hr. A study of the practices of plant propagation and the factors involved in reproduction in plants.
- 229. **Landscape Design.** I. 3 hr. (1 lec., 1 scheduled lab., 1 arranged lab.). A course in ornamental horticulture giving an appreciation of the basic principles of design and information pertaining to the use and care of ornamental plants around the home.
- 242. **Small-Fruits.** I. 3 hr. (2 lec., 1 scheduled lab.). The taxonomic, physiological, and ecological principles involved in the production and handling of small-fruits.
- 243. **Physiology of Vegetables.** I. 3 hr. (2 lec., 1 scheduled lab.). Physiological and ecological principles involved in the production of vegetable crops.
- 244. **Handling and Storage of Horticultural Crops.** II. 3 hr. (2 lec., 1 scheduled lab.). Characteristics of perishable crops. Methods and materials employed to maintain quality.
- 301. **Post-Harvest Physiology.** II. 3 hr. (1 lec., 2 labs.). Physiology and biochemistry of harvested crops.
- 320. **Special Topics.** I, II, S. 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.).
- 350. **Seminar.** I, II. 1 hr. (1 seminar). Recent literature in the plant sciences which pertains to horticultural science.
- 397. **Research.** I, II, S. 1-15 hr. per sem.

Landscape Architecture

- 241. **Planting Design.** I. 3 hr. PR: Hort. 161, Hort. 162, or consent and L.A. 51. Laboratory design problems in the use of plant materials with emphasis on plants as objects of the design and their association and arrangement for landscape effect.
- 242. **Planting Design.** II. 3 hr. Continuation of L.A. 241.
- 248. **Design Analysis.** II. 3 hr. PR: L.A. 150, 241. Analysis of executed problems through discussion involving basic theory, readings, and reports.
- 250. **Landscape Architectural Design.** I. 5 hr. PR: L.A. 151, 242. Advanced design problems; a continuation of L.A. 150 and 151 with emphasis on site function and detail.
- 251. **Landscape Architectural Design.** II. 5 hr. Continuation of L.A. 250.
- 265. **Regional Design.** I. 3 hr. PR: Consent of department chairman. Survey of regional landscapes to gain an understanding of the relationships of the causal factors requisite to conceptualization of the visual-physical form of the regional environment.
- 276. **Recreation Planning.** I. 3 hr. PR: L.A. 151. Design of park and recreation areas involving park history, classification theory, and administration.
- 278. **Site Planning Projects.** I. 4 hr. PR: L.A. 250. Preparation of site plans and master programs, housing subdivisions, and institutional areas. Professional practice and ethics are integrated with the master program.
- 284. **Professional Practice.** II. 2 hr. The profession of landscape architecture involving the procedures in the preparation of contract documents, fees, estimates, operation of an office, and the relationship to clients and contractors.

Entomology

202. **Agricultural Entomology.** II. 4 hr. PR: Zool. 1, 2. A course dealing with the basic aspects of insect life, emphasizing the study of economically important insects and their control. Designed to meet the needs of students in agriculture. Does not carry graduate credit for majors in Entomology.
313. **Insect Transmission of Plant Disease.** I. 3 hr. PR: Pl. Path. 153, 201, or Entom. 202. Role of insects in spread and development of plant diseases. Offered in Fall of odd years.
320. **Special Topics.** I, II, S. 2-6 hr. PR: Entom. 202. Advanced study of entomological topics of special interest to the student.
350. **Seminar.** I, II. 1 hr. per sem.
397. **Research.** I, II, S. 1-15 hr. per sem.

PLANT PATHOLOGY AND BACTERIOLOGY

Graduate students in Plant Pathology or Bacteriology must hold a Bachelor's Degree from an approved college. To enter into graduate work without condition in these fields the student must have *an adequate background of approved courses in biology or agriculture*. Additional undergraduate work in chemistry, physics, mathematics, or botany may be required according to the needs of the field of specialization followed by the student. Admission to candidacy is conditioned upon a suitable period in residence and a demonstrated ability to do work of graduate caliber.

A candidate for the Master's Degree in Plant Pathology or Bacteriology must pass satisfactorily 30 credits of approved work of which 6 may be for a thesis. A thesis is required.

The doctorate is offered only in Plant Pathology and Agricultural Microbiology and candidates for these degrees are governed by the general regulations of the Graduate School.

Agricultural Bacteriology

247. **Food Microbiology.** I. 4 hr. PR: Bact. 141, organic chemistry or consent. The ecology and physiology of microorganisms important in the manufacture and deterioration of foods, and the techniques for the microbiological examination of foods. Offered in Fall of even years.
248. **Sanitary Bacteriology.** I. 3 hr. PR: Bact. 141. Standard bacteriological methods used in routine examination of water sewage. Offered in Fall of odd years.
314. **Soil Microbiology.** II. 4 hr. PR: Bact. 141 and organic chemistry. Occurrence and distribution of microorganisms in soils and their interrelationships. Their role in decomposition of organic matter and other transformations of soil constituents. Offered in Spring of odd years.
320. **Special Topics.** I, II, S. 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.)
350. **Seminar.** I, II. 1 hr. per sem.
397. **Research.** I, II, S. 1-15 hr. per sem.

Plant Pathology

201. **General Plant Pathology.** I. 4 hr. PR: Bact. 141. Nature and causes of plant diseases; methods of control.
202. **Principles of Plant Pathology.** II. 4 hr. PR: Bact. 141 and either Pl. Path. 152, 201, or 203, or consent. Primarily for graduate students and seniors majoring in botany, biology, or agricultural science. Nature of disease in plants with practice in laboratory methods. Offered in Spring of even years.
203. **Mycology.** I. 4 hr. Lectures, field and laboratory studies of parasitic and saprophytic fungi.

209. **Nematology.** I. 3 hr. PR: Pl. Path. 201 or consent. Primarily for graduate students majoring in the agricultural sciences, zoology, or botany. Nematode taxonomy, bionomics, and control, with particular emphasis on plant parasitic forms. Offered in Spring of odd years.
301. **Diseases of Economic Plants.** I, II, S. 1-3 hr. per sem., 2 hr. in summer. PR: Plant Path. 201 and 203 or consent. Recognition, cause, and control of diseases of economic plants; Sem. I, Diseases of vegetable crops and of tree and small fruits; Sem. II, Diseases of ornamental plants and field and forage crops. S, Diseases of forest trees. Students may register for 1-3 hr. in Sem. I and II, 2 hr. in Summer, until 8 hours of credit are accumulated. Offered in 1969-70 and in alternate years.
302. **Physiology of Plant Diseases.** I. 2 hr. PR: Ag. Biochem. 291 and Plant Path. 202, or consent. A study of host-parasite interactions, with emphasis on the physiological and biochemical changes that occur in higher plant tissues in response to pathogenic organisms. Offered in Fall of even years.
320. **Special Topics.** I, II, S. 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.).
330. **Physiology of the Fungi.** II. 4 hr. PR: Organic chem., mycology, and bact., or consent. Physiological aspects of growth, reproduction, and parasitism of fungi, with emphasis on nutrition, environment, and other biotic factors.
340. **Taxonomy of the Fungi.** S. 3 hr. PR: Pl. Path. 203. Collection and identification of fungi with emphasis upon those of economic importance. Offered in Summer of odd years.
350. **Seminar.** I, II. 1 hr. per sem.
397. **Research.** I, II, S. 1-15 hr. per sem.

FORESTRY

The Degree of Master of Science in Forestry

Graduate students in Forestry must hold a Bachelor's Degree from an approved college. To enter into graduate work without condition the student must have an adequate background of approved courses in mathematics, the physical and biological sciences, and forestry. Unless the student is a graduate of a four-year forestry curriculum, he may be required to take additional undergraduate courses.

Students may major in forest ecology, forest economics, forest genetics, forest hydrology, forest management, forest mensuration, forest protection, silviculture, or wood industries.

A candidate for the Degree of Master of Science in Forestry must pass satisfactorily 30 credits of approved work, of which 6 may be for a thesis. A thesis is required.

The Degree of Master of Science

This degree may be obtained in the fields of wood science and technology, wildlife management, and recreation. Fulfillment of the general regulations for graduate degrees is required.

Forestry

204. **Principles of Forestry Economics.** II. 3 hr. PR: Econ. 51 and 52 or equiv. The economics of production, distribution, and use of forest goods and services. Emphasis is on analytical methods and techniques in dealing with forest economic problems.
212. **Silvicultural Systems.** I. 4 hr. PR: For. 11. Principles of regeneration cuttings, intermediate cuttings, and cultural operations, with their application to forest stands.

213. **Forest Genetics and Tree Improvement. I.** 3 hr. PR: Genetics 171 or equivalent or consent. Forest genetic principles and their application to forest tree improvement including crossing methods, selection systems, and other tree improvement techniques.
214. **Advanced Principles of Forestry Economics. I.** 3 hr. PR: Econ. 51 and 52, For. 204 or equivalent. Intensive study of both the micro- and macro-economics of forestry.
216. **Regional Silviculture. I.** 2 hr. PR: For. 11; PR or conc: For. 212. Major forest types of the United States; their composition, management, problems, and silvicultural treatment.
217. **Forest Management Plans. II.** 2 hr. PR: For. 223. Analyses of forest management plans. Construction of a sustained yield timber management plan for a specific forest tract.
218. **Principles and Practices of Artificial Forestration. II.** 3 hr. PR: For. 11. Seedling and planting nursery practice; phases of artificial regeneration.
220. **Forest Policy and Administration. II.** 3 hr. Forest policy in the United States; important federal and state laws; administration of public and private forests; problems in multiple-use forestry.
222. **Forest Mensuration. II.** 3 hr. PR: For. 21. The measurement of growth and yield; statistical methods applied to forest measurement problems.
223. **Forest Management. I.** 4 hr. PR: Summer Camp; PR or conc: For. 212. The principles of sustained yield forest management. Organization of the forest area, selection of management objectives, application of silvicultural systems, and regulation of the cut. The forest management plan.
224. **Forest Finance. II.** 2 hr. PR or conc: For. 204. Cost and income items in producing and exploiting forest crops; appraisal of stumpage and damages.
225. **Wood Finishing. I.** 3 hr. PR: For. 130 or For. 131 or consent. A technical course in wood finishing covering surface preparation, composition of finishing materials, equipment, techniques, defects, trouble-shooting and quality control.
226. **Remote Sensing of Environment. II.** 2 hr. PR: For. 21. Elements of photogrammetry; preparation of maps; interpretation of forest types and timber volumes from aerial photographs.
230. **Forest Products Protection. II.** 3 hr. PR: For. 131, 135 or consent. Study of the biological organisms responsible for the deterioration of wood products and their control by preservative methods.
231. **Wood Microstructure. I.** 3 hr. PR: For. 131, Senior standing, or consent. A detailed examination of wood microstructure as it relates to processing, behavior, and identification.
232. **Mechanical Properties of Wood. I.** 3 hr. PR: T.A.M. 102. Properties and behavior of wood as a structural material.
233. **Principles of Industrial Forestry.** 3 hr. PR: Senior standing or consent. Analysis and case studies of problems pertinent to the integration of wood conversion technology with principles of production, marketing and management.
235. **Wood Moisture Relationship. II.** 3 hr. PR: For. 131. Purposes, effects, and methods of seasoning and preserving wood.
238. **Statistical Quality Control. II.** 3 hr. PR: For. 135. A study of methods used to control quality of manufactured wood products. Control charts of variable and attributes. Acceptance sampling techniques.

239. **Theory and Practice of Wood Adhesion.** I. 3 hr. PR: For. 131 and 132 or consent. Examination of different types of adhesives and bonding techniques used in the wood industry.
241. **Wildlife Techniques.** II. 3 hr. PR: For. 141, 145, Bot. 161 or consent. Field and laboratory techniques necessary in the management and study of wildlife; collection of field data, mapping, censusing, habitat evaluation, literature, and reports are stressed.
242. **Wildlife Population Ecology.** I. 3 hr. PR: For. 141 or equiv.; Stat. 211 or equiv. Theory of population growth, population change, intraspecific and interspecific relationships that are involved in the natural regulation of population, and the effects of man on populations of wild game.
243. **Wildlife Ecology.** I. 4 hr. PR: Biol. 1 and 2. Basic principles of animal ecology and their application to wildlife. Field and laboratory studies of major ecosystems important to wildlife, including management of these ecosystems for wildlife.
244. **Forest Zoology.** II. 3 hr. PR: Biol. 2 or Zool. 2. The relationship of mammals, reptiles, amphibians, and fish to the forest, with emphasis on the ecology and taxonomy of these groups.
245. **Principles of Wildlife Management.** II. 3 hr. PR: For. 243 or consent. A survey of the major game animals and the problems and principles involved in their management.
251. **Forest Fire Protection.** I. 2 hr. Preventative action, preparation activities, and control of forest fires.
311. **Environmental Relationships in Hardwood Forests.** I. 3 hr. PR: For. 212. The study of environmental factors affecting establishment, composition, and growth of hardwood forests.
312. **Silvicultural Practices for Hardwood Forest Types.** II. 3 hr. PR: For. 212, 216. Designing proper silvicultural systems for managing Appalachian hardwood stands; reconstructing stand histories, recognizing problems, and prescribing appropriate silvicultural treatment.
315. **Advanced Forest Regulation.** I, II. 2 hr. PR: For. 223 or equiv. An intensive study of area and volume regulation suitable for applied forestry in the United States.
- 320, 321. **Special Topics.** I, II. 1-6 hr. per sem. PR: Consent. (For the Master of Science Degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.).
345. **Ecology and Management of Upland Wildlife.** II. 4 hr. PR: Consent. Ecology and management of upland game birds and mammals, with emphasis on recent literature.
346. **Ecology and Management of Wetland Wildlife.** II. 4 hr. PR: Consent. Ecology and management of waterfowl and wetland furbearers with emphasis on recent research and management literature.
350. **Seminar in Silviculture.** I, II. 1 hr. per sem.; max. credit, 4 hr. PR: Consent. Reports and discussions of recent research in fundamental and applied phases of silviculture with emphasis on hardwood forest types.
352. **Seminar in Wood Utilization.** I, II. 1 hr. per sem.; max. credit, 4 hr. PR: Consent. Reports and discussions of recent research in fundamental and applied phases of wood utilization.
354. **Wildlife Seminar.** II. 1 hr. per sem.; max. credit 4 hr. PR: Consent. Discussion of current developments in wildlife management.
397. **Research.** I, II, S. 1-15 hr. per sem. PR: Consent. For graduate students working on a thesis problem.

Recreation

202. **Philosophy of Recreation.** II, S. 3 hr. PR: Major students in Recreation, Forestry, graduate students in Education and Physical Education; or consent. Interpretation of recreation as a basic part of the living process; importance to individual community, and national welfare; social and economic significance.
204. **Recreation Hobbies.** I, S. 2 hr. PR: Rec. 1 or equiv. Lecture and workshop. Value of hobbies to youth and adults; participation in various types or hobbies; methods of organization and presentation; nature and scope.
206. **Social Recreation for School-Age Groups.** II, S. 3 hr. PR: 12 hr. in Education or consent. Workshop course. Planning and conduct of social activities, parties, picnics, special events and other recreation experience adapted to home, church, school, and community.
265. **Leisure and Recreation.** I, S. 3 hr. PR: Physical Education, Forestry, Recreation majors or 14 hr. in Education or consent. Study of leisure as a social phenomenon in our modern culture and its implications for recreation.
271. **Administration of Camps and Preparation of Camp Counselors.** II, S. 3 hr. PR: Rec. 11 or equiv. or consent. Principles involved in modern camping programs; organization and administration of camps.
282. **Administration of Recreation.** I, S. 3 hr. PR: Major in Recreation, Forestry, graduate status in Education or Physical Education, or consent. General principles of administration; organization of staff administrative procedures. Study of enabling laws, legal responsibilities, survey, finance, programs, facilities, and public relations.
290. **Outdoor Education and School Camping.** 3 hr. PR: For majors in Education, Recreation, Extension, and Forestry, or consent. Course designed to meet the needs of schools, colleges, and other education and conservation agencies interested in developing outdoor education programs. Emphasis is upon interpretation and programming of the outdoor education concept.
293. **Outdoor Recreation in Our Modern Society.** 3 hr. PR: For persons in fields of recreation, park, outdoor education and conservation, or consent. Interpretation as to what it is, what people do, where they go, how this affects our economic, social, and cultural life and significant trends.
305. **Human Interest Areas in Recreation Planning.** I, II, S. 3 hr. PR: Rec. 202 or 20 hr. in Education or equiv. Exploration of the human interest areas which are the sources of recreation program content. Their adaptation to school and municipal recreation program planning.
306. **Leadership in School-Age Recreation Programs.** II, S. 2 hr. PR: Rec. 107 or two years' teaching experience. Leadership techniques used in various recreation activities of school-age groups. Analysis of differences between teaching and recreation leadership.
307. **Community Recreation.** I, S. 3 hr. PR: Rec. 202 or consent. A study of problems related to the provision of adequate recreation services for a community. Standards and quality of recreation service; methods of measuring existing services and their coordination; and community organization procedures. Course is designed for leaders in voluntary agencies, schools, churches, and municipal recreation organizations.
394. **Seminar in Recreation.** I, II, S. 4 hr. PR: Rec. 202. An overview and critical analysis of the literature and research in recreation.
397. **Individual Research Problems in Recreation.** I, II, S. 1-15 hr. PR: Minimum of 6 sem. hr. in Recreation, including, Rec. 202 or 265, HPERS 375 or 395, or Educ. 301. Opportunity for independent study and investigation of pertinent problems. For advanced students with practical experience.
398. **Practicum in Recreation.** I, II, S. 4 hr. PR: Rec. 394, HPERS 396 and 397. Program planning, curriculum development, and job functions in recreation.

Arts and Sciences

BIOLOGY

The Department of Biology offers work leading to the degrees of Master of Arts in Biology, Master of Science, and Doctor of Philosophy in either Botany or Zoology. The department has certain requirements in addition to those of the Graduate School. Current information concerning the graduate programs of the department should be acquired by writing the Chairman, Department of Biology, before seeking admission to the Graduate School. The enrollment of degree candidates is subject to the availability of satisfactory research space and facilities for thesis work. Students may enroll in graduate courses and may work toward an advanced degree only with the approval of the department.

Applicants are expected to have a broad foundation of training in biology and in related sciences, particularly chemistry, mathematics, and physics. Deficiencies in undergraduate training may prolong the required course program for advanced degrees.

A permanent summer field station, The Terra Alta Biological Station, located at Terra Alta in Preston County offers two summer sessions for course work and research. Write to TABS, Department of Biology for descriptive folder.

Course offerings listed below are subject to change.

Biology

- 207. **History of Biology.** I. 3 hr. PR: Biol. 2. History of the development of biological knowledge, with philosophical and social backgrounds.
- 208. **Great Texts of Biology.** II. 1 hr. PR: Biol. 2 or equiv. A study of some of the great classics in biology, such as Theophrastus' *Enquiry into Plants*, Vesalius' *Epitome*, Harvey's *Motion of the Heart and Blood*, Darwin's *Origin of Species*, and Mendel's *Experiments on Hybrid Plants*.
- 215. **Cytology.** II. 4 hr. PR: Biol. 2. Cells, their development and structure.
- 296, 297. **Special Topics.** I, II. 1-4 hr. per sem. PR: Consent. Critical studies of topics to be assigned by the instructor.
- 321. **Seminar in Ecology.** I. 1 hr. per sem. PR: Bot. 221, Zool. 224 or For. 242 and consent. Selected topics on relations of organisms to environment and on communities of organisms.
- 376, 377. **Seminar.** I, II. 2 hr. per sem. PR: Biol. 274, Bot. 273, Zool. 271, or Pl. Path. 330, and consent. Selected topics on functions common to all organisms.

Botany

- 201, 202. **Seminar.** I, II. 1 hr. Topics of general interest to botanists are considered.
- 221. **Plant Ecology.** I. 4 hr. PR: Biol. 2 or equiv. Environmental relationships of plants.
- 224. **Plant Communities.** S. 3 hr. PR: Biol. 2 or equiv. Field studies in the plant ecology of the central Appalachians.
- 227. **Geographic Botany.** I, S. 2 or 3 hr. PR: Biol. 2 Study of plant groupings and worldwide distribution of plants.
- 231. **Plant Morphology.** I. 4 hr. PR: Biol. 2. Development and structure of algae and fungi.
- 232. **Plant Morphology.** II. 4 hr. PR: Biol. 2 or Bot. 2. Development and structure of bryophytes and vascular plants.

235. **Plant Anatomy. I.** 4 hr. PR: Biol. 2 or equiv. Anatomy of seed plants.
236. **Plant Morphogenesis. II.** 4 hr. PR: Organic Chem. or Biochem.; Pl. Anat. or Cytology, Pl. Phys. or Genetics. Experimental studies of plant growth and development.
250. **Fresh Water Algae. I.** 4 hr. PR: Biol. 1, 2. Taxonomy, cytology, and ecology of aquatic, aerial and land forms of fresh-water algae.
255. **Bryophytes. II.** 2 hr. PR: Biol. 2. Identification of liverworts and mosses.
256. **Vascular Cryptogams. II.** 4 hr. PR: Biol. 1, 2. Taxonomy, anatomy, cytology, and ecology of the club-mosses, horsetails, and ferns.
261. **Advanced Systematic Botany. I.** 3 hr. PR: Bot. 161 or equiv. Taxonomy of pteridophytes, gymnosperms, and monocotyledons.
262. **Advanced Systematic Botany. II.** 3 hr. PR: Bot. 161 or equiv. Taxonomy of dicotyledons.
263. **Taxonomy of Vascular Plants. S.** 3 hr. PR: Biol. 2 or equiv. Field studies in the taxonomy of higher plants.
265. **Aquatic Seed Plants. I.** 3 hr. PR: Biol. 2 or equiv. Classification, ecology, and economic importance of aquatic seed plants.
266. **Flora of West Virginia. II, S.** 3 hr. PR: Biol. 2 or equiv. A consideration of the native plant life of the State.
268. **Dendrology. II. S.** 2 hr. PR: Biol. 2. Identification and classification of woody plants.
- 296, 297. **Special Topics. I, II.** 1-4 hr. per sem. PR: Consent. Critical studies of topics to be assigned by the instructor.
316. **Cytotaxonomy. II.** 3 hr. PR: Biol. 2, Bot. 161, Genet. 221, or consent. The determination of phylogenetic relationships by cytological and taxonomic methods.
325. **Experimental Plant Ecology. II.** 2-4 hr. PR: Bot. 161, and Bot. 221 or equiv. Advanced field studies in plant ecology.
331. **Plant Embryology. II.** 2 hr. PR: Biol. 2 and consent. Gametogenesis, syngamy, an embryo development in vascular plants.
- 351, 352. **Problems in Plant Taxonomy. I, II.** 1-6 hr. PR: Bot. 261, 262, or equiv.
374. **Advanced Plant Physiology. I, II.** 3 hr. PR: Bot. 171 or equiv., organic chemistry, general physics, and consent. Advanced studies of plant processes including recent advances in the field. I. Fall semester, even numbered years—Respiration, photosynthesis, and related processes. II. Spring semester, odd-numbered years—Water relations and mineral nutrition and translocation. III. Fall semester, odd-numbered years—Plant growth and development. IV. Spring semester, even-numbered years—Environmental physiology.
397. **Research. I, II, S.** 1-15 hr.

Zoology

210. **Animal Behavior. I.** 3 hr. PR: Biol. 2 or equiv. Principles of individual and group behavior.
222. **Field Studies of Invertebrates. S.** 3 hr. PR: Biol. 2 or equiv. Taxonomy and ecology of the invertebrates.
223. **Field Studies of Vertebrates. S.** 3 hr. PR: Biol. 2 or equiv. Taxonomy and ecology of the vertebrates.
224. **Limnology. I.** 4 hr. PR: Biol. 121 or consent. Physics, chemistry, and biota of inland waters emphasizing biological productivity.

231. **Comparative Anatomy.** I. 5 hr. PR: Biol. 2 or equiv. Organs and systems of various vertebrates, together with other facts of interest concerning these animals.
232. **Vertebrate Embryology.** II. 5 hr. PR: Biol. 2 or equiv. Introductory study of development of vertebrates, based on frogs, fowls, and mammals.
233. **Comparative Histology.** II. 4 hr. PR: Zool. 231 and consent. Limited to seniors and graduate students. A comparative study of tissues of the vertebrates.
235. **Comparative Developmental Anatomy.** II. 3 hr. PR: Zool. 231. Anatomy and development of the organs and systems of various vertebrates.
236. **Comparative Neuroanatomy.** II. 4 hr. PR: Biol. 104 or Zool. 231, and consent. Comparative study of development and anatomy of the nervous systems of the vertebrates.
237. **Osteology.** I. 2 hr. PR: Biol. 2 or equiv. Development and anatomy of the skeleton.
251. **Invertebrate Zoology.** I. 4 hr. PR: Biol. 2 or equiv. Advanced study of animals without backbones.
255. **General Parasitology.** I. 4 hr. PR: Upper division standing and consent. The biology of parasites.
263. **Ichthyology.** II. 3 hr. PR: Biol. 104 or consent. Systematics and evolution of fishes with a comparative treatment of genetics development, anatomy, and physiology. Offered only in odd-numbered years.
264. **Fisheries Biology.** II. 4 hr. PR: Zool. 263 or consent. Population dynamics in relation to principles and techniques of fish management. Offered only in even-numbered years.
265. **Ornithology.** II. 3 hr. PR: Biol. 2 or equiv.; consent. Field and laboratory studies on identification, migration, protection, nesting, and food habits of birds.
271. **Human Physiology.** I, II, S. 4 hr. An introductory course in the functions of man.
272. **Physiology of the Endocrines.** I. 4 hr. PR: Organic chemistry and vertebrate embryology or consent. Regulation of the organs of internal secretion, mechanisms of action of the hormones, and experimental techniques used in study of the endocrine system.
275. **Vertebrate Physiology.** I. 4 hr. PR: Zool. 2 or equiv. The functions of vertebrate organs and organ systems.
276. **Comparative Physiology.** II. 4 hr. PR: Biol. 1 and 2 and organic chemistry or consent. A study of the diverse ways in which different kinds of animals meet their functional requirements.
- 296, 297. **Special Topics.** I, II. 1-3 hr. per sem. Critical studies of topics to be determined according to the student's requirements.
331. **Special Topics in Comparative Vertebrate Anatomy.** I, II. 1-4 hr. PR: Consent. Critical studies of topics to be determined in consultation with the instructor.
332. **Special Topics in Vertebrate Embryology.** I, II. 1-4 hr. PR: Consent. Critical studies of topics to be determined in consultation with the instructor.
351. **Advanced Invertebrate Zoology.** I, II. 1-4 hr. PR: Zool. 251 and consent.
368. **Mammalogy.** I. 3 hr. PR: Biol. 1 and 2 or equiv., and 8 hr. upper division. The study of mammals and their biological properties with emphasis on the life history, ecology, and distribution of regional forms. Offered only in even-numbered years.
397. **Research.** I, II. 1-15 hr.

CHEMISTRY¹

The Department of Chemistry offers graduate studies leading to the degree of Master of Science and Doctor of Philosophy with research concentration in the areas of analytical, inorganic, organic, physical, and theoretical chemistry. Both of these degrees require completion of a research project which represents the principal theme about which the graduate program is constructed.

Applicants for graduate studies in chemistry must have as a minimum requirement a bachelor's degree with a major or concentration in chemistry and an appropriate background in physics and mathematics. All entering graduate students in chemistry are required to take Departmental Guidance Examinations in the major areas of chemistry. These examinations, on the undergraduate level, are administered prior to registration and serve to guide the faculty in recommending a course program for the beginning graduate student. Deficiencies revealed on the Guidance Examinations needs to be corrected in a manner prescribed by the faculty.

The general Graduate School requirements for the Master of Science degree have been outlined elsewhere in this bulletin. Graduate students in the M.S. program in the Department of Chemistry are required to submit a research thesis and thus may enroll in a maximum of 6 hours of research. The remaining 24 hours of credit must be earned in basic graduate courses which reflect a diversified exposure to chemistry; no more than 10 hours may be elected outside the Department of Chemistry. A final oral examination of the M.S. candidate is administered after completion and submission of the thesis.

The program for the degree of Doctor of Philosophy reflects a flexible, research-oriented approach geared to develop the interests, capability and potential of mature students. A program of courses is recommended to suit individual needs based on background, ability, and maturity. These courses are classified as basic graduate courses which present the essentials of a given discipline on an advanced level, and specialized graduate courses which take one to the frontiers in a specific area of research. The course offerings are designed to provide guidelines from which graduate students can launch their independent studies in preparation for Candidacy Examinations. Students are required to enroll in the departmental seminar program and are expected to attend special lectures and seminars offered by visiting chemists.

All graduate students in the Ph.D. program are expected to achieve a certain diversified background in the major areas of chemistry. This may be ascertained in some cases by the Guidance Examinations combined with academic record while in other instances courses are necessary (such as two semesters of physical chemistry and one semester of organic chemistry). The Departmental Graduate Studies and Guidance Committee aids in establishing when students begin the Candidacy Examinations which consist of both a written and oral portion. The written examinations are of the cumulative type and are offered ten times a year. The oral examination is based on a proposition for a research problem not intimately related to the student's own problem, or any particular research problem being actively pursued at West Virginia University. This proposition is presented in writing to the student's research committee and defended before that group and any other interested faculty members.

Completion of the language requirement which may be taken in German and French, or Russian, and satisfactory completion of the candidacy examinations is required before a student is admitted to candidacy for the Ph.D. degree.

Research which is the major theme of graduate studies may be initiated as early as the student and faculty feel appropriate for each individual case. Normally a student will begin laboratory work during his first summer or in September of the following year. Upon successful completion of an original piece of research, the candidate will present his results in a Ph.D. dissertation and at the appropriate time defend his work in a final oral examination.

Details regarding the Graduate School requirements for the M.S. and Ph.D. degrees and information about financial assistance available for graduate students in chemistry can be found in earlier portions of this bulletin. Additional questions on these matters may be directed to the Chairman of the Department of Chemistry.

¹For information concerning courses in chemistry available in the Kanawha Valley Graduate Center of West Virginia University, write to: Dean, Kanawha Valley Graduate Center of West Virginia University, P. O. Box 547W, Nitro, W. Va. 25143.

Laboratory Fees

A non-refundable fee is required of all students who register for the following laboratory courses in Chemistry.

Chem. 202	\$16.00	Chem. 220	\$16.00
Chem. 210	16.00	Chem. 235	16.00
Chem. 211	16.00	Chem. 239	16.00

Chemistry

202. **Selected Topics. I, II.** 3 hr. PR: Consent. Individual instruction under supervision of an instructor.
210. **Instrumental Analysis. II.** 3 hr. PR: Chem. 143 and 235. Basic instrumentation of analytical measurements. Two periods of lecture and one 3-hr. laboratory each week.
211. **Intermediate Analytical Chemistry. I.** 3 hr. PR: Chem. 210 or concurrent enrollment. Basic concepts of analytical procedures and separations. Two periods of lecture and one 3-hr. laboratory each week.
220. **Techniques of Chemical Syntheses. II.** 2 hr. PR or conc: Chem. 221. Techniques of preparing and handling inorganic materials. Crystallization, highly oxidizable substances, complex compounds, sealed tube, inert atmosphere, microscopy, and other special techniques. Two 3-hr. laboratories each week.
222. **Chemistry of Inorganic Compounds. II.** 3 hr. PR: Chem. 242. A correlation of the reactions and properties of elements and their compounds based on atomic structure, valence theories, spectra and the periodic system. Three periods of lecture each week.
231. **Advanced Organic Chemistry I. I.** 3 hr. PR: Chem. 134. Structural concepts (orbital representations, resonance, stereochemistry), reaction mechanisms and synthetic applications (condensation reactions, nucleophilic substitution and addition) in organic chemistry at an advanced level. Three periods of lecture each week.
232. **Advanced Organic Chemistry II. II.** 3 hr. PR: Chem. 231. Synthetic organic chemistry with particular emphasis on aromatic systems, oxidation and reduction techniques, molecular rearrangements, and a review of recent synthetic methods. Three periods of lecture each week.
235. **Methods of Structure Determination. I.** 4 hr. PR: Chem. 134, 136. Both chemical and physical methods are used to study unknowns. Required of chemistry majors. One period of lecture and two 3-hr. laboratories each week.
239. **Organic Syntheses. II.** 2 hr. PR: Chem. 136. Modern synthetic methods of organic chemistry. Two 3-hr. laboratories each week.
241. **Chemical Thermodynamics. I.** 3 hr. PR: Chem. 144. Principles of classical and statistical thermodynamics and their application to chemical problems. Three periods of lecture each week.
242. **Chemical Bonding and Molecular Structure. I.** 3 hr. PR: Chem. 144 and 210. An introduction to the quantum theory of chemical bonding. Atomic structure, spectroscopy, predictions of molecular structures and bond properties. Three periods of lecture each week.
244. **Colloid and Surface Chemistry. II.** 2 hr. PR: Physical Chemistry. Selected topics in the properties and physical chemistry of systems involving macromolecules, lyophobic colloids, and surfaces. Two periods of lecture each week.
- 311, 312. **Seminar in Analytical Chemistry. I, II.** 1 hr. per sem. Current literature and research in the area of analytical chemistry.

313. **Electrochemistry and Instrumentation.** I. 3 hr. PR: Chem. 210. Electronic instrumentation as applied to the study of mass transfer, kinetics of electrode reactions, voltammetry, and high-frequency methods. Three periods of lecture each week.
314. **Spectroscopic Methods.** II. 3 hr. PR: Chem. 210. Problems in the design of instruments for each of the various spectral regions. Three periods of lecture each week.
- 317, 318. **Advanced Topics in Analytical Chemistry.** I, II. 1-3 hr. per sem. Recent advances and topics of current interest in the area of analytical chemistry.
- 321, 322. **Seminar in Inorganic Chemistry.** I, II. 1 hr. per sem. Current literature and research in the area of inorganic chemistry.
323. **Advanced Inorganic Chemistry.** I. 3 hr. PR: Chem. 221. Advanced topics in modern inorganic chemistry including bonding theories, stereochemistry, non-aqueous solvent systems, physical methods and current topics. Three periods of lecture each week.
324. **Coordination Chemistry.** II. 3 hr. PR: Chem. 221, corequisite Chem. 242. Ligand field theory, spectral interpretations, stability considerations, synthetic methods, unusual oxidation states, organometallic compounds, other topics of current interest. Three periods of lecture each week.
325. **Inorganic Reactions and Mechanisms.** I or II. 2 hr. PR: Chem. 323, 324 and 343. A detailed study of substitution, isomerization, racemization, and oxidation-reduction reaction. Two periods of lecture each week.
326. **Chemistry of Non-Metals.** I or II. 3 hr. PR: Chem. 221. Electrodeficient compounds, sulfur-fluorine chemistry, inorganic polymers, rare gas compounds, solid-state chemistry of silicon and germanium, other topics of current interest. Three periods of lecture each week.
- 327, 328. **Advanced Topics in Inorganic Chemistry.** I, II. 1-3 hr. per sem. Recent advances and topics of current interest in the area of inorganic chemistry.
- 331, 332. **Seminar in Organic Chemistry.** I, II. 1 hr. per sem. Current literature and research in the area of organic chemistry.
333. **Physical Organic Chemistry.** I. 3 hr. PR: Chem. 231. Theoretical considerations of organic molecules, kinetics and other methods used in the study of organic structure and reaction mechanisms, linear free energy relationship and other related topics. Three periods of lectures each week.
335. **Polymer Chemistry.** I or II. 2 hr. PR: Chem. 231. Polymerization processes (methods, reaction types, mechanisms), structural determination and concepts, physical and chemical properties of polymers. Two periods of lecture each week.
336. **Heterocyclic Chemistry.** I or II. 3 hr. PR: Chem. 231. A systematic survey of the chemistry of the major heterocyclic systems and discussion of selected natural products containing heterocycles. Three periods of lecture each week.
- 337, 338. **Advanced Topics in Organic Chemistry.** I, II. 1-3 hr. per sem. Recent advances and topics of current interest in the area of organic chemistry.
- 341, 342. **Seminar in Physical Chemistry.** I, II. 1 hr. per sem. Current literature and research in the area of physical chemistry.
343. **Chemical Kinetics.** II. 3 hr. PR: Chem. 144. Theories and applications of kinetics in gaseous state and in solution. Three periods of lecture each week.
344. **Statistical Mechanics.** I or II. 3 hr. PR: Chem. 346. Theory and application of statistical mechanics to chemical systems. Three period of lecture each week.
345. **Theoretical Chemistry I.** I. 3 hr. PR: Differential equations. Theoretical background for quantum mechanics. Three period of lecture each week.

346. **Theoretical Chemistry II.** II. 3 hr. PR: Chem. 345. Theories and applications of quantum mechanics in chemistry. Three periods of lecture each week.
347. **Molecular Spectroscopy and Structure.** I. 3 hr. PR: Chem. 346. An advanced course in the application of spectral methods to a study of molecular structure. Three periods of lecture each week.
- 348, 349. **Advanced Topics in Physical Chemistry.** I, II. 1-3 hr. per sem. Recent advances and topics of current interest in the area of physical chemistry.
397. **Research.** I, II. 1-15 hr. Six hours are required for the Master's degree. Students may enroll more than once. Electrochemistry, crystallography, coordination chemistry, unusual oxidation states, organic and inorganic preparations, organic reaction mechanisms, infrared, microwave, nmr, and radio-frequency spectroscopy, and quantum mechanical calculations are some of the topics currently being investigated.

ECONOMICS

Graduate programs in Economics leading to the Master of Arts and Doctor of Philosophy degrees are listed and discussed under the College of Commerce section on page 105.

ENGLISH LANGUAGE AND LITERATURE

Admission: To be admitted to the Department of English as a prospective candidate for the degree of Master of Arts, a student is expected to have completed work comparable to the Department's undergraduate requirement for English majors and to present a record distinctly above the average.

If as an undergraduate the applicant majored in English, the general average of grades in all English courses must be no lower than B. If the applicant's average in all English courses is lower than B, the Committee on Admissions may extend a "Probational Admission" for one semester, at the end of which the student's status will be determined by the Committee.

If as an undergraduate the applicant majored in a subject other than English, he will be admitted only on condition that he fulfill, to the extent of his particular deficiency, the normal course and credit obligations of the undergraduate English major at West Virginia University. Such an admission is termed a "Conditional Admission."

Course Requirements: A candidate for the M.A. degree will be expected to complete courses covering the major periods and the works of the major authors of English literature. The minimum requirement is 36 hours of graduate work.

Examinations: In addition to the final oral examination related particularly to the student's field of special interest as reflected in the Master's thesis, a graduate student in English is required to take two three-hour comprehensive written examinations in English and American literature. The student will normally take these examinations in the semester or term following that in which he has established acceptable credit in 24 hours of graduate course work with an average of 3.0. The examinations will be conducted not later than four weeks before the last day of classes of a semester, or three weeks before the end of a summer term. With the permission of the Examining Committee, an unsuccessful candidate may be re-examined. Success in the examination admits the student to candidacy for a graduate degree.

Thesis: For students who have entered or may enter graduate status in the Department prior to the first semester 1969-70, the writing of a thesis shall remain optional under the terms stated in the *Graduate School Announcements* for 1968-69. A student who enters in the fall of 1969 or later shall be required to write

a thesis of a type and on a subject approved by the Department. The student will write under the supervision of a thesis adviser to be assigned. Information about the procedure and the dates for filing application for approval of projects, and about dates for submission of theses, is available at the office of the Department. The thesis may be a work of scholarship, of criticism, or of creative writing (original poetry, drama, or fiction).

The thesis shall count for six hours of graduate credit.

Foreign Language Requirement: A candidate for the degree of Master of Arts in English must have completed studies in a foreign language (preferably French or German) equivalent to 12 semester hours of college work. If an applicant does not meet this requirement, he may prepare to meet it through independent study, or otherwise, in order to show a reading knowledge on examination.

English

218. **Creative Writing. II.** 3 hr. PR: English 115 and 116 or 117 or their equivalent, or by consent. An advanced workshop in creative writing, designed for students who are seriously engaged in the writing of a major work.
222. **Modern American Biography. I.** 3 hr. A selection of the most significant and interesting biographies and autobiographies of Americans of distinction in literature, the arts, and public life.
223. **Modern British Biography. II.** 3 hr. Representative works by such eminent masters of biography as Lytton Strachey, Sir Osbert Sitwell, Lord David Cecil, Sean O'Casey, Hugh Kingsmill, and others.
224. **Literary Criticism. II.** 3 hr. The history of literary criticism from Aristotle to modern times.
225. **Recent Literary Criticism. I, II.** 3 hr. A brief survey of the theories and essays of four major schools of modern criticism and an application of these theories to a novel, a play, and to selected poems and short stories.
228. **Structure of the English Language. I, II.** 3 hr. A course in historical, comparative, and descriptive grammar, together with an introduction to English linguistics.
230. **History of the English Language. I.** 3 hr. A study of the nature of the language; questions of origins, language families, development, relationship of English as one of the Indo-European languages.
231. **Old English (I). I.** 3 hr. A study of Anglo-Saxon with selected reading from the literature of the period.
232. **Old English (II). II.** 3 hr. PR: English 231. Beowulf and other texts in Old English.
234. **Chaucer. I.** 3 hr. Early poems, Troilus and Criseyde, and The Canterbury Tales. In addition to an understanding and appreciation of Chaucer's works, the student is expected to acquire an adequate knowledge of Chaucer's language.
235. **Shakespeare. I.** 3 hr. Intensive study of selected plays. Special attention to textual problems and to language and poetic imagery, together with the history of Shakespearean criticism and scholarship.
236. **Shakespearean Comedies and History Plays. I.** 3 hr. A study of representative comedies of Shakespeare against the background of classical and Renaissance theory and practice, and of selected history plays.
237. **Shakespearean Tragedy. II.** 3 hr. A study of the principal tragedies of Shakespeare, together with the history of criticism, scholarly investigation, and interpretation.
239. **Southern Writers. I.** 3 hr. Examination of twentieth-century Southern essayists, poets, short-story writers, and novelists in relation to the ideological background.

242. **Literature for Teachers.** S. 3 hr. Study and appreciation of selected works of American authors, with special reference to the high-school curriculum. Given usually in the Summer Session.
243. **Literature for Teachers.** S. 3 hr. Study and appreciation of selected works of English authors. Recommended for teachers of high-school English. Given usually in the Summer Session.
244. **Sixteenth Century Prose and Poetry.** I. 3 hr. Studies from Caxton to Bacon, from Skelton to Shakespeare.
245. **Seventeenth Century Prose and Poetry.** II. 3 hr. Studies from Donne to Dryden.
247. **Literature of the Eighteenth Century.** I. 3 hr. Literature of the period 1700-1750, studied in relation to the social, political, and religious movements of the time.
248. **Literature of the Eighteenth Century.** II. 3 hr. Continuation of English 247, covering the latter half of the century. May be taken independently of English 247.
249. **The Romantic Movement.** I. 3 hr. The works of Wordsworth, Coleridge, and Keats, together with an introduction to works of scholarship in the field of English Romanticism.
250. **American Romanticism.** II. 3 hr. The writing of Ralph Waldo Emerson, Henry David Thoreau, and Nathaniel Hawthorne. A study of the relations of these men to the history of their own time, and of their contributions to American thought and art.
252. **English Literature, 1880-1918.** 3 hr. A study of the more important writers and literary movements of the late Victorian and the Edwardian periods with emphasis on Hardy, Housman, Hopkins, Henley, Pater, Gissing, Moore, Butler, and the writers of the "Aesthetic movement."
253. **Early English Drama.** I. 3 hr. A study of the medieval and early Tudor drama, to the age of Shakespeare.
254. **Elizabethan Drama.** II. 3 hr. A study of the dramas of Shakespeare's contemporaries and successors to the closing of the theatres in 1642. Includes Kyd, Marlowe, Peele, Green, Jonson, Heywood, Marston, Chapman, Webster, Beaumont and Fletcher, Massinger, Ford, and Shirley.
255. **Restoration and Eighteenth Century Drama.** II. 3 hr. Comedy, tragedy, the heroic play, the drama of sensibility and the reaction against it: Etherege, Wycherley, Farquhar, Congreve, Vanbrugh, Dryden, Otway, Goldsmith, and Sheridan.
256. **Modern Drama.** II. 3 hr. A study of world drama from Ibsen to the present day.
257. **Victorian Poetry.** I. 3 hr. A study of the major Victorian poets — Tennyson, Browning, Arnold, Rossetti, Morris, Swinburne, and Fitzgerald, and a few of the later Victorian poets.
258. **Victorian Prose.** II. 3 hr. A study of the non-fictional writings of the great Victorian prose critics: Carlyle, Ruskin, Arnold, Newman, Macaulay, Huxley, and Morris.
261. **American Drama.** I. 3 hr. A study of representative American dramas and of the history of the theatre in America.
262. **Study of Selected Authors.** (American). I, II. 3 hr. A study of the works of a principal American author, or of more than one, as announced when the course is scheduled.
263. **Study of Selected Authors.** (English). I, II. 3 hr. Study of the works of one or more of the principal English authors, as announced in the schedule when the course is listed.

264. **Spenser.** I. 3 hr. A study of Spenser's minor poems and *The Faerie Queene*; forms and sources, purpose of the great epic, social, political, and religious allegory.
265. **Byron and Shelley.** II. 3 hr. Reading and study of the works of two poets of the later Romantic Movement, together with works of criticism and scholarship related to the period.
267. **Milton.** II. 3 hr. A study of all of Milton's poems and a few selected prose works.
270. **American Poetry.** I. 3 hr. A study of the major American poets of the nineteenth and twentieth centuries—Bryant, Poe, Emerson, Longfellow, Whitman, Dickinson, Frost, Eliot. Primary emphasis on their poetry as poetry; background materials minimized.
272. **Folk Literature.** I. 3 hr. A study of the folk ballad, its origin, history, and literary significance, based on Child's collection and on American ballad collections.
273. **Folk Literature of the Southern Appalachian Region.** II. 3 hr. A study of the traditional literature of the people of the Southern Appalachian Region, including songs, prose tales, language, customs, based on material collected in the region, especially in West Virginia.
275. **The English Novel to the Time of Scott.** I. 3 hr. A study of the English novel from the sixteenth century to the time of Scott, showing the development of the novelistic art from early narrative beginnings.
276. **The English Novel, 1832-1900.** II. 3 hr. A continuation of English 275. The development of the English novel from the early nineteenth century to the beginning of the twentieth century.
278. **Tragedy.** II. 3 hr. Masterpieces of tragedy from Greek times to modern, with consideration of the changing concepts of tragedy and of the ethical and ideological values reflected in the works of major tragic authors.
280. **The Modern Novel.** I, II. 3 hr. The twentieth-century novel, with emphasis upon the work of selected British novelists.
282. **Modern British Poetry.** I. 3 hr. A survey of British poetry from 1890 to the present, including the Decadents, Counter-Decadents, Hopkins, Housman, Hardy, the Georgians, the Imagists, and war poets; Yeats, Eliot, the Auden Group, and the post-World War II poets.
291. **Introduction to Literary Research.** I, II. 3 hr. Bibliography; materials and tools of literary investigation; methods of research in various fields of literary history and interpretation; problem of editing. Practical guidance in the writing of theses.
300. **Thesis.** I, II. 3 hr.
301. **Thesis.** I, II. 3 hr.
- 321, 322. **Medieval Literature.** I, II. 3 hr. each sem. PR: Graduate standing.
- 331, 332. **The Renaissance.** I, II. 3 hr. each sem. PR: Graduate standing. Literary and cultural influences from the Continent on the English literature of the late fifteenth and early sixteenth centuries. Discussion and analysis of major English literary works of the period.
- 341, 342. **English Drama to 1642.** I, II. 3 hr. each sem. PR: Graduate standing. A consideration of the varied aspects of English drama from its medieval beginnings to the middle of the seventeenth century. Discussion and analysis of selected dramas.
- 353, 354. **The Eighteenth Century.** I, II. 3 hr. each sem. PR: Graduate standing.
- 361, 362. **Romanticism.** I, II. 3 hr. each sem. PR: Graduate standing. Studies in major authors and special topics in the field of English Romanticism.

- 371, 372. **The Victorian Era.** I, II. 3 hr. each sem. PR: Graduate standing. Writers of the Victorian period considered in relation to the cultural matrix from which they rise. Particular attention is given to the varying intellectual currents of the era.
- 377, 378. **Folklore and Folk Literature.** Seminar. 3 hr. each sem. PR: Graduate standing. Research projects in folklore, including field work in collecting folklore in the Appalachian region and the analysis of the use of folklore in the works of British and American authors.
- 390, 391. **Seminar.** I, II. 3 hr. PR: Graduate standing. Seminar in principal authors and movements in American literature from the Colonial Period to 1870, with emphasis on topics and authors announced in the schedule.
392. **Seminar.** I, II. 2 or 3 hr. PR: Graduate standing. Specific authors to be approved by the instructor. A graduate study of particular periods of authors.
- 393, 394. **American Literature, 1870- .** I, II. 3 hr. each sem. PR: Graduate standing. Literary and intellectual America from 1870 to 1914 in terms of leading literary men and changing cultural patterns of the period. Discussion and analysis of selected prose and poetic works.

FOREIGN LANGUAGES

The Department of Foreign Languages offers graduate study in French, Spanish, German, Latin, and Greek literature and culture, in linguistics, in language teaching methods, and in bibliography and research. The department also directs a master's program in Latin American Area Studies. Candidates for the master's degree are accepted in French, Spanish, and German, and in Latin American Area Studies.

A student who wishes to do graduate work in this department should apply to the chairman of the department, who will act as his adviser until the student becomes a candidate for a graduate degree. Usually, he will be expected to have an undergraduate major in a foreign language, preferably the one in which he proposes to major. He should normally show an average of at least 3.0 (B) in his undergraduate foreign language courses.

A candidate must complete at least 36 graduate hours for a master's degree, 24 to 27 hours of which, including Bibliography and Research 265, will be in his major field. A prospective elementary or secondary school teacher, who has not attended an NDEA foreign language institute, is expected to complete Language Teaching Methods 221, 222, or both, as part of the work in the major field. Six hours of the major work may take the form of a master's thesis. The candidate's committee will make all decisions as to the distribution of courses and the thesis requirement in the light of the student's aims and needs.

French

203. **Refresher Course in Conversational French.** 3 hr. PR: A.B. in French or consent. Intensive spoken French designed primarily for teachers of French in the elementary school.
205. **Fundamentals for Reading French.** I. 3 hr. Undergraduate credit only. Graduate students must register as auditors. PR: Graduate status or upper-division status. The sequence 205-206 is intended for graduate students from other departments to teach them to read general and technical French.
206. **Reading French.** II. 3 hr. Undergraduate credit only. Graduate students must register as auditors. PR: 12 hr. of French or equiv. or French 205. Graduate students may meet the doctoral foreign language requirement by achieving a grade of B or better in this course. Not open to Foreign Language Department majors.
217. **French Civilization.** II. 3 hr. PR: 12 hr. of French.

221. **The Romantic Movement. I.** 3 hr. PR: French 118 or consent.
222. **French Realism. II.** 3 hr. PR: French 118 or consent.
226. **Literary Criticism. II.** 3 hr. PR: A.B. in French or consent.
227. **Graduate Reading in French.** No Credit. A special course to help students prepare for the Ph.D. reading examination in French.
229. **Literature of the 16th Century. I.** 3 hr. PR: A.B. in French or consent.
231. **Phonetics and Pronunciation. II.** 3 hr. PR: 18 hr. of French or equiv.
237. **Moliere. II.** 3 hr. PR: French 115.
241. **French Structural Linguistics.** 4 hr. PR: 12 hr. of French. A special course for the NDEA Language Institute.
242. **Methods in French Secondary Teaching.** 4 hr. PR: 12 hr. of French. A special course for the NDEA Language Institute.
244. **Explication De Textes. II.** 3 hr. PR: 18 hr. of French or equiv.
271. **The Modern Novel to 1930. I.** 3 hr. PR: A.B. in French or consent.
272. **The Novel After 1930. II.** 3 hr. PR: A.B. in French or consent.
281. **Medieval French Literature. II.** 3 hr. PR: Linguistics 290 (Old French) or consent.
292. **Pro-Seminar in French Literature.** 1-6 hr. Special topics.
301. **Thesis.** 3-6 hr.
392. **Seminar in French Literature.** 1-6 hr. Special topics.

Spanish

211. **Nineteenth Century Literature to 1870. I.** 3 hr. PR: Spanish 3 and 4, or equiv.
212. **Spanish Literature Since 1870. II.** 3 hr. PR: Spanish 3 and 4, or equiv.
215. **Lyric Poetry. I.** 3 hr. PR: 12 hr. of Spanish, or equiv.
216. **Spanish Civilization and Culture. I.** 3 hr. PR: 12 hr. of Spanish, or equiv.
217. **Spanish-American Literature and Culture. I.** 3 hr. PR: 12 hr. of Spanish, or equiv.
218. **Spanish-American Literature and Culture. II.** 3 hr. PR: 12 hr. of Spanish, or equiv. Continuation of Spanish 217.
221. **Literature of the Golden Age to 1635. I.** 3 hr. PR: 18 hr. of Spanish, or equiv.
222. **The Golden Age After Lope De Vega. II.** 3 hr. PR: 18 hr. of Spanish, or equiv.
223. **Estudios De Estilo. I.** 3 hr. PR: 18 hr. of Spanish, or equiv.
224. **Explicacion De Textos. II.** 3 hr. PR: 18 hr. of Spanish, or equiv.
225. **The Picaresque Novel. I.** 3 hr. PR: 18 hr. of Spanish, or equiv.
227. **Graduate Reading in Spanish.** No credit. A special course to help students prepare for the Ph.D. reading examination in Spanish.
241. **Spanish Structural Linguistics.** 4 hr. PR: 12 hr. of Spanish. A special course for the NDEA Language Institute.
242. **Methods in Spanish Secondary Teaching.** 4 hr. PR: 12 hr. of Spanish. A special course for the NDEA Language Institute.
291. **Cervantes. II.** 3 hr. PR: 18 hr. of Spanish or consent.
292. **Pro-Seminar in Spanish Literature.** 1-6 hr. Special topics.
295. **Sixteenth Century Literature. I.** 3 hr.

- 297. **Pro-Seminar in Spanish-American Studies**, 1-6 hr. Special topics.
- 301. **Thesis**, 3-6 hr.
- 392. **Seminar in Spanish Literature**, 1-6 hr. Special topics.
- 395. **Seminar in Spanish-American Studies**, 1-6 hr. Special topics.

German

- 201. **Independent Reading**, I. 3 hr. Supervised reading for students who wish to do intensive work in any field of interest.
- 202. **Independent Reading**, II. 3 hr. Continuation of German 201.
- 227. **Graduate Reading in German**. No credit. A special course to help students prepare for the Ph.D. reading examination in German.
- 242. **Faust**, II. 3 hr. PR: German 4 or consent. Critical study of Goethe's Faust.
- 243. **Medieval German Literature**, I. 3 hr. PR: German 4 or consent.
- 244. **German Literature of the Reformation and Renaissance**, II. 3 hr. PR: German 4 or consent.
- 245. **Classicism and Romanticism**, I. 3 hr. PR: German 4 or consent. A critical study of German literature from 1750 to 1830.
- 246. **The Liberal Age**, II. 3 hr. PR: German 4 or consent. A critical study of German literature from 1830 to 1880, with an emphasis upon poetic realism.
- 247. **The Age of Crisis**, II. 3 hr. PR: German 4 or consent. A critical study of German literature from 1880 to the present.
- 265. **German Civilization**, I. 3 hr. PR: 12 hr. of German or consent. A general comprehensive survey of the most important aspects of German culture, including a brief historical background, the development of the German language, geography, science, music, art, architecture, literature, and philosophy.
- 275. **The Modern Novel**, I. 3 hr. PR: 18 hr. of German. Supervised reading of nineteenth century novels.
- 276. **The Modern Novel**, II. 3 hr. Continuation of German 275, with emphasis on recent fiction.
- 292. **Pro-Seminar in German Literature**, 1-6 hr. Special topics.
- 301. **Thesis**, 3-6 hr.
- 396. **Seminar in German Literature**, 1-6 hr. Special topics.

Russian

- 211. **The Russian Novel**, I. 3 hr. PR: Russian 3 and 4 or consent. Study of selected work of Gogol, Goncharov, Turgenev, Leskov, Dostoevsky, and Tolstoy.
- 212. **The Russian Novel**, II. 3 hr. Continuation of Russian 211. Study of Russian prose from Chekhov to the post-war Soviet novelists.

Latin

- 201. **Roman Novelists**, I. 3 hr. PR: Latin 109, 110, or equiv. The origin of the novel is traced from Homer to the Medieval Greek and Latin romance writers. Readings include selections from Petronius, the *Cena Trimalchionis*, and from Apuleius, *Cupid and Psyche*.
- 202. **Roman Comedy**, II. 3 hr. PR: Latin 109, 110, or equiv. A brief history of the origin and development of Greek and Roman comedy. Readings include the *Menaechmi* of Plautus, and the *Andria* of Terence.

231. **Roman Satire. I.** 3 hr. PR: Latin 109, 110, or equiv. Greek satirical writings and the origin of the Roman satire. Readings include selections from the *Satires* of Horace, and from the *Satires* of Persius and Juvenal.
234. **Roman Historians. I.** 3 hr. PR: Latin 109, 110, or equiv. The origin and development of Roman historiography and its Greek antecedents. Readings include selections from Livy's *History*, from Tacitus' *Agricola*, and from Suetonius' *Augustus*.
235. **Roman Epic. I.** 3 hr. PR: Latin 109, 110, or equiv. The origin and development of the Greek and Roman epic. Readings include selections from Vergil's *Aeneid*, from Lucretius' *De Rerum Natura*, and from the earlier and later epic poets.
236. **Roman Philosophers. II.** 3 hr. PR: Latin 109, 110, or equiv. The origin and development of Greek philosophy and its influence upon Roman philosophy. Readings include selections from Cicero's *Tusculan Disputations* on the immortality of the soul and from Seneca's *Epistles*.
237. **Roman Lyric Poetry. I.** 3 hr. PR: Latin 109, 110, or equiv. Origin and development of the Greek and Roman lyric poetry. Readings include selections from Horace, Catullus, Tibullus, and Propertius.
292. **Pro-Seminar in Latin Literature.** 1-6 hr. Special topics.
301. **Thesis.** 3-6 hr.
392. **Seminar in Latin Literature.** 1-6 hr. Special topics.

Greek

292. **Pro-Seminar in Greek Literature.** 1-6 hr. Special topics.
392. **Seminar in Greek Literature.** 1-6 hr. Special topics.

Linguistics

201. **Linguistics As Applied to Spanish American Dialects. I.** 3 hr. PR: A.B. in Spanish or consent. For students majoring in Latin American Area Studies to acquaint them with the principles of structural linguistics and those points of structure and vocabulary in which American Spanish differs from standard Castilian.
211. **Middle High German. I.** 3 hr. PR: 12 hr. of German from upper division. Study of the linguistic developments of Middle High German from the eleventh to the fifteenth centuries with illustrative reading from the *Nibelungenlied*.
212. **Middle High German. II.** 3 hr. Continuation of Linguistics 211 with illustrative readings from the Middle High German lyric poets and the courtly epics.
225. **Comparative Grammar of Greek and Latin. I.** 3 hr. PR: Consent.
226. **Italic Dialects. II.** 3 hr. PR: Consent.
227. **Vulgar Latin. II.** 3 hr. PR: Latin 109, 110, or equiv. Selections from Latin inscriptions and later Latin literature are studied to illustrate the development of the Latin language from its earliest times to its passing into the Romance languages.
231. **The Structure of Modern Russian. I.** 3 hr. PR: Russian 3 and 4 or consent. Advanced study of Russian phonetics and phonemics.
232. **The Structure of Modern Russian. II.** 3 hr. PR: Linguistics 231 or consent. Advanced study of Russian morphology and syntax.
241. *See French 241 and Spanish 241.*

251. **History of the German Language. I.** 3 hr. PR: 18 hr. of German or consent. A study of the historical development of standard German with emphasis on its relationships to the other Germanic languages and dialects.
252. **Comparative Germanic Linguistics. II.** 3 hr. PR: Linguistics 251 or consent. A comparative study of Gothic, Old English, Old Norse, Old High German, and Old Saxon.
255. **History of the Spanish Language. I.** 3 hr. PR: A.B. in Spanish or consent. A study of the development of the Spanish language and of the transformation of the Castilian dialect into the national language of Spain.
271. **Old English. I.** 3 hr. PR: Consent. Elementary study of Old West Saxon with illustrative materials from prose and poetry.
272. **Old English. II.** 3 hr. Continuation of Linguistics 271. Comparison of the Old English dialects, with extensive illustrative readings, especially in *Beowulf*.
281. **Old Norse. I.** 3 hr. PR: Consent. Elementary study of Old West Norse prose.
282. **Old Norse. II.** 3 hr. Continuation of Linguistics 281. Readings in various Old Icelandic sagas; introduction to Old Norse poetry.
290. **Old French. II.** 3 hr. PR: Consent.
292. **Pro-Seminar in Linguistics.** 1-6 hr. Special topics.
296. **Old Spanish. II.** 3 hr. PR: Consent.
392. **Seminar in Linguistics.** 1-6 hr. Special topics.

Language Teaching Methods

221. **The Teaching of Foreign Languages. I.** 3 hr. Required of all graduate students who are prospective foreign language teachers.
222. **Language Laboratory Techniques. II.** 3 hr. Required of all candidates for a graduate degree in a foreign language.
242. *See French 242 and Spanish 242.*
270. **Problems in Teaching Foreign Languages in the Elementary School (French, Spanish, German, Russian).** 3 hr. PR: Consent. A methods course in the teaching of foreign languages with a demonstration class of elementary school pupils.

Bibliography and Research

265. **Methods of Research. I.** 3 hr.

Latin American Area Studies

The Master of Arts degree in Latin American Area Studies is an interdisciplinary degree. It is based on 39 credit hours, six of which may be obtained in residence at a selected Latin American university.

The courses are intended for graduate students who hold a bachelor's degree, preferably with a major in Spanish, History, Economics, Political Science, Geology, or Sociology and who wish to prepare themselves for some type of work in Latin America.

Each candidate accepted will be assigned to a committee composed of at least one member from the Department of Foreign Languages and other members from the supporting departments.

The objectives of the program are: to make sure the student has a thorough knowledge of Spanish for all purposes, to furnish the student a good background in Latin American culture, and to give the student a sound basis for future teaching, research, or other professional work requiring knowledge of Latin America.

Basic requirements for all candidates are: Spanish 217, 218, 297, 395, Linguistics 201, Geography 219.

Additional courses under this program are grouped as follows:

Group I. History 220, 221, Political Science 246, 255, 267.

Group II. Economics 250, 251, Sociology 260, and six hours of special courses in Anthropology.

Group III. Art 275, Botany 296, Agriculture 320, three hours of special work in Pathology.

The students may complete the requirements for his degree in either of the following ways:

1. At least nine hours from Group I and three hours from Group III, plus additional courses from Groups I, II, or III as desired.

2. At least nine hours from Group II and three hours from Group III, plus additional courses from Group I, II, or III as desired.

GEOLOGY AND GEOGRAPHY

The Department of Geology and Geography offers work leading to the degrees of Master of Arts, Master of Science, and Doctor of Philosophy in Geology. No graduate degree are offered in Geography.

The Degree of Master of Arts

This degree enables the holder of a baccalaureate degree to become well acquainted, although not professionally trained, in the earth sciences. The program is directed toward teachers, businessmen, and research administrators.

Acceptance by the Graduate School and also by the Department of Geology and Geography is necessary before admission of any prospective student to the program. One departmental requirement is previous college study of scientific subjects. This requirement may be fulfilled by an undergraduate major (or first teaching field) in biology, chemistry, physics, or engineering.

The minimum course work involved is 36 hours (32 of which are at graduate level). This includes 24 hours of specified work, and allows 12 or more hours in optional and related areas (at least 3 hours of which are in geology). Up to 9 hours of cognate work at the graduate level (in biology, chemistry, physics, engineering, mathematics, or education) may be included in the program. No thesis is required.

The Degree of Master of Science

Before being admitted to candidacy for the Master of Science degree in Geology, the student must have completed the equivalent of the courses listed in the college of Arts and Sciences section of the *Undergraduate Catalog* as curricular requirements for undergraduates majoring in Geology. Students who have not had more than a year of physics, a year of chemistry, and mathematics through Math. 15 (Calculus I), will be required to meet these requirements. They therefore will spend more than the minimum time for the Master of Science or Doctor of Philosophy degrees. Most employment requirements in technical fields, such as petroleum geology, now include not only advanced physics and chemistry but also mathematics through calculus. Employment opportunities are limited unless this requirement is met. Graduate students are expected to take some supporting courses in such allied fields as mining engineering, geophysics, and biology—depending on their major field of geologic studies.

A grade-point average of at least 3.0 (B) is required for an advanced degree in all courses in geology taken in the department while a graduate student. Scores in the general aptitude and geology tests of the Graduate Record Examination must be submitted. Each student must pass satisfactorily a comprehensive qualifying examination as an additional requirement before being admitted to candidacy for an advanced degree.

A thesis is required of all candidates for the Master of Science degree in geology. The thesis may be based on field work done while not in residence at the

University by arrangement with the candidate's advisory committee. Final examinations (usually oral) on general geologic knowledge and thesis subject must be passed by each candidate for an advanced degree.

Prospective students are urged to write the Chairman of the Department of Geology and Geography before making application to the Director of Admissions of the University for admission to the Graduate School.

The Degree of Doctor of Philosophy

In addition to the requirements above, the general requirements for the Doctor's degree are set forth in Part II of this bulletin.

Opportunities for Research

Close cooperation between the West Virginia Geological and Economic Survey, located in Morgantown, and the Department of Geology makes a large amount of material available for laboratory investigation. This includes the fossil collections of the Department and the Survey. A large number of samples of drill cuttings from deep wells in West Virginia and adjoining states are housed in the Survey. Morgantown is conveniently situated for detailed studies of Mississippian, Pennsylvanian, and Permian formations. Mineral products of the region near Morgantown include coal, petroleum, natural gas, and limestone. The occurrence and utilization of these materials can be studied by graduate students interested in economic geology. A permanent summer field camp (Camp Wood) is located in the Folded Appalachians at Alvon, Greenbrier County, West Virginia.

Geology

201. **Physical Geology for Teachers.** I, II, S. 3 hr. PR: High School teaching certificate, and consent. Composition and structure of earth and the geologic processes which shape its surface.
202. **Physical Geology Laboratory for Teachers.** I, II, S. 1 hr. Accompanies Geol. 201. Laboratory and field study of earth materials and features, and the topographic and geologic maps used to represent them.
221. **Geomorphology.** I. 3 hr. Study of surface features of eastern United States.
222. **Geomorphology.** II. 3 hr. Study of surface features of western United States.
228. **Photogeology.** II. 3 hr. PR: Geol. 127, 151. Instruction in basic and advanced techniques of air photo interpretation.
231. **Invertebrate Paleontology.** II. 4 hr. PR: Geol. 3, 4. Invertebrate fossils; biologic classification, evolutionary development, and use in correlation of strata.
235. **Introductory Paleobotany.** I, II. 4 hr. PR: Geol. 3 and/or Bot. 2. Résumé of development of principal plant groups through the ages, present distribution, mode of occurrence and index species, methods of collection.
261. **Stratigraphy and Sedimentation.** II. 3 hr. Study of sediments and sedimentary rocks. Field techniques stressed as data gathered and interpreted from rocks of Pennsylvanian age in Morgantown vicinity. Two-day field trip required.
262. **Sedimentology Field Camp.** S. 3-6 hr. PR: Geol. 261 or equiv. Field-lab. course in experimental, modern, and ancient sedimentation. Living expenses in addition to tuition must be paid at time of registration.
263. **Ground-water Hydrology.** II. 3 hr. PR: Geol. 1 or consent. Study of the principles of ground-water hydrology; occurrence, development, uses, and conservation of ground-water.
266. **Appalachian Geology Field Camp.** S. 6 hr. PR: Geol. 231, 261. Practical experience in detailed geological field procedures and mapping. Living expenses in addition to tuition must be paid at time of registration.
269. **X-Ray Diffraction.** I, II. 3 hr. The theory of X-ray diffraction and application to the analysis of crystalline materials using the powder camera and X-ray diffractometer. Open to advanced students in geology, chemistry, engineering and related fields with consent of instructor.

270. **Mineral Resources.** I, S. 3 hr. PR: Geol. 1, 2. General survey of character, origin, and distribution of natural mineral resources, including mineral fuels, nonmetallic minerals, ore deposits, and ground-water.
272. **Petroleum Geology.** II. 1-4 hr. PR: Geol. 151. Origin, geologic distribution, methods of exploration and exploitation, uses and future reserves of petroleum and natural gas in the world.
274. **Problems in Economic Geology and Geochemistry.** I, II. 1-4 hr.
285. **Optical Mineralogy.** I. 4 hr. PR: Geol. 185 and one year of Physics. Principles and practice in use of the petrographic microscope in identification of minerals. Emphasis on determination by immersion method.
290. **Geologic Problems.** I, II. 1-6 hr. Special problems for seniors and graduates.
291. **Seminar.** I. 1 hr.
294. **Introductory Geochemistry.** I. 3 hr. PR: Geol. 185 or consent. Evolution of earth as suggested by chemical and physical data, followed by topics of current interest, including geologic thermometry, oxidation potential and pH, and geochemical prospecting.
295. **Geochemistry.** II. 3 hr. PR: Geol. 185 or consent. Mineral systems at low temperatures and low pressures considered in terms of partial pressure, oxidation potential and pH. Laboratory study includes directed investigation of a topic of interest to the student.
329. **Problems in Geomorphology.** I, II. 1-4 hr.
332. **Micropaleontology.** I. 4 hr. PR: Geol. 231. Identification of Foraminifera and Ostracoda; emphasis on classification, nomenclature, and use of paleontological literature.
334. **Problems in Paleontology.** I, II. 1-4 hr.
336. **Advanced Paleobotany.** I, II. 4 hr. Continuation of Geol. 235.
339. **Problems in Paleobotany.** I, II. 1-4 hr.
340. **Advanced Stratigraphy.** II. 4 hr. PR: Geol. 231. Study of principles of rock and time correlation, emphasis on their application to the stratigraphy of West Virginia.
344. **Clay Geology.** I, II. 2-3 hr. PR: Geol. 185, 261, 269. Study of clay mineralogy with secondary emphasis on the origin and deposition of clay minerals in the stratigraphic record.
346. **Advanced Sedimentation.** I. 4 hr. PR: Geol. 185. Origin of sedimentary rocks; principles involved in interpretation of ancient geography, climates, animals, and plants.
348. **Problems in Sedimentation.** I, II. 1-4 hr.
349. **Problems in Stratigraphy.** I, II. 1-4 hr.
351. **Tectonic Elements.** II. 3 hr. PR: Geol. 151. Detailed analyses of tectonic elements of North America and Europe.
359. **Problems in Structural Geology.** I, II. 1-4 hr.
371. **Economic Geology: Ore Deposits.** II. 3 hr. PR: Geol. 185. Mineral composition, geologic features, and distribution of deposits of principal useful metallic minerals.
372. **Economic Geology: Nonmetallics.** I. 3 hr. PR: Geol. 185. Occurrence, formation, and use of nonmetallic mineral substances, including building materials and chemicals.
386. **Petrology.** II. 4 hr. PR: Geol. 285. Composition, texture, occurrence, and origin of rocks. Study of hand specimens and thin sections.

387. **Advanced Petrology. I.** 3 hr. PR: Geol. 386. Study of the composition, classification, and origin of igneous and metamorphic rocks. Laboratory work consists of a study of crystalline rocks by microscopical methods.
388. **Problems in Mineralogy and Petrology. I, II.** 1-4 hr.
397. **Research. I, II.** 1-15 hr.; max. 15 hr. per sem. Students may enroll more than once for this course.

Geography

214. **Historical Geography of Anglo-America. II.** 3 hr. Exploration, settlement, and changing patterns of human occupancy from the sixteenth century to the present; cultural areas and their significance.
216. **Urban Geography. II.** 3 hr. Location, development, and change of urban land use patterns.
218. **Political Geography. I.** 3 hr. Examination of spatial interrelationships of man and his environment in a political setting.
219. **Problems in Geography. I, II.** 1-3 hr. per sem.; max. 12 hr.
220. **Seminar in Geography. I, II.** 1-3 hr. per sem.; max. 12 hr.
240. **Geography of the USSR and Eastern Europe. II.** 3 hr. Regional characteristics and problems of development.
251. **Cartography. I.** 3 hr. Theory and practice of map design.

HISTORY

The Degree of Master of Arts

Candidates for the Master's degree should have had 18 hours of upper-division undergraduate work in history and 9 hours of upper-division undergraduate work in some closely related subject, preferably economics, political science, or sociology. A reading knowledge of one foreign language is desirable.

The Department of History requires that all candidates for the Master of Arts degree in history present an overall average of 3.0 (B) for all graduate courses taken; it will not accept toward an advanced degree credits in courses offered by the Department of History which are reported with a grade lower than "B."

Early in the course the candidate should select a thesis subject, the development of which will require research of at least a semi-independent character. Before the degree is conferred the candidate will be required to pass a satisfactory examination in the field of his thesis and such related fields as may be determined by him in conference with his departmental adviser.

The thesis must be in the hands of the departmental adviser at least thirty days before date of the oral examination, which will be conducted by a committee selected by the adviser and approved by the Dean of the Graduate School. Six hours credit will be allowed for an acceptable thesis. With the approval of the adviser, the candidate for the Master's degree may substitute course work for the thesis requirement, provided that he shall have satisfactorily completed 36 semester hours of graduate study, which shall include a minimum of 24 hours in History, at least 6 of which shall be courses of the 300 seminar series. Those electing to obtain the Master's degree by this option will be required to pass a final comprehensive examination (either oral, written, or both) in the fields covered by the course work.

The Degree of Doctor of Philosophy

A candidate for the Doctor's degree must offer a program of study in at least four fields, three of which must be in history and the other may be in a related field in another department. The program must be approved by the departmental adviser and the Dean of the Graduate School, but not until the candidate has shown his ability to pursue it by a qualifying examination, given by a committee of the Department, to determine his general knowledge of the entire field of history.

In addition to the qualifying examination, a candidate for the degree shall submit, before the end of the first year of his residence, a piece of research approved by the departmental adviser to satisfy the Department of History of his fitness to proceed with graduate work. After a period of residence, but not until he shall have met the requirement of ability to read two foreign languages, the candidate will be required to take a comprehensive preliminary examination (oral, written, or both) in four fields, of which three must be in history.

The groups from which the fields may be selected are:

Group A—

- History of the United States to 1865
- History of the United States since 1850

Group B—

- Medieval and Renaissance Europe
- Europe, 1500-1815
- Europe, 1789 to Present
- History of England

Group C—

- Latin America
- History of Asia
- Field in another department

Besides conforming to general regulations of the Graduate School, the doctor's dissertation must show: (1) a thorough mastery of the original sources of information; (2) good literary form or style; and (3) an acceptable standard of documentation, to the end that all important statements of fact may be verified. Upon the satisfactory completion of the dissertation, the candidate is required to take a final oral examination. This examination is designed to bring out the candidate's critical ability and reasoning power and is based on the field covered by the dissertation.

History

- 200. Social and Economic History of the Middle Ages, 300-1000. 3 hr.
- 201. Social and Economic History of the Middle Ages, 1000-1500. 3 hr.
- 202. The Renaissance. 3 hr.
- 203. The Reformation. 3 hr.
- 204. English Social History, 14th to 18th Century. 3 hr.
- 205. English Social History, 18th Century to the Present. 3 hr.
- 206. French Revolution and Napoleon. 3 hr.
- 207. History of Modern France. 3 hr.
- 208. History of Russia from Ancient Times to Alexander III. 3 hr.
- 209. History of Russia: The Revolutionary Era and the Soviet Period. 3 hr.
- 210. European Diplomatic History, 1815 to 1919. 3 hr.
- 211. European Diplomatic History, 1919 to Present. 3 hr.
- 212. History of Germany from the Roman Era to the Early 19th Century. 3 hr.
- 213. History of Modern Germany. 3 hr.
- 214. History of Modern Spain. 3 hr.
- 215. History of Modern China. 3 hr.
- 216. History of Modern Japan. 3 hr.
- 230. The ABC Powers of Latin America. 3 hr.
- 250. Economic and Social Development of West Virginia. 3 hr.

253. The American Frontier East of the Mississippi. 3 hr.
254. The American Frontier West of the Mississippi. 3 hr.
255. History of the Negro in America. 3 hr.
256. The Old South. 3 hr.
257. The American Civil War. 3 hr.
258. The New South. 3 hr.
259. The United States from McKinley to the New Deal, 1899 to 1933. 3 hr.
260. American Diplomacy to 1901. 3 hr.
261. American Foreign Policy and Diplomacy, 1901 to the Present. 3 hr.
269. Recent American History, 1933 to the Present. 3 hr.
279. American Economic History to 1865. 3 hr.
280. American Economic History Since 1865. 3 hr.
281. The American Labor Movement. 3 hr.
290. Intellectual and Social History of the United States to 1876. 3 hr.
291. Intellectual and Social History of the United States Since 1876. 3 hr.
292. European Intellectual History to the Age of the Enlightenment. 3 hr.
293. European Intellectual History from the Age of the Enlightenment to the Present. 3 hr.
- 302, 303. Readings, Seminar, in Medieval History. 3 hr.
- 304, 305. Readings, Seminar, in English History. 3 hr.
- 306, 307. Readings, Seminar, in Western European History. 3 hr.
- 308, 309. Readings, Seminar, in Central European History. 3 hr.
- 310, 311. Readings, Seminar, in Eastern European History. 3 hr.
- 312, 313. Readings, Seminar, in Asian History. 3 hr.
- 349, 350. Problems in Local and Regional History. 3 hr.
- 351, 352. Readings, Seminar, in American History, 1492-1789. 3 hr.
- 353, 354. Readings, Seminar, in American History, 1763-1865. 3 hr.
- 355, 356. Readings, Seminar, in American History, 1850-1898. 3 hr.
- 357, 358. Readings, Seminar, in American History, 1890 to the Present. 3 hr.
- 359, 360. Readings, Seminar, in Frontier History. 3 hr.
361. The History of American Agriculture. 3 hr.
362. The Cleveland Era. 3 hr.
376. American Historiography. 3 hr.
377. European Historiography. 3 hr.
- 391, 392. Thesis. 1-6 hr.
- 393, 394. Research. 1-15 hr.; max. 15 hr. per sem.

LIBRARY SCIENCE

Admission Requirements: Students wishing to do graduate work in Library Science must satisfy the general requirements for admission to the Graduate School.

The Department of Library Science offers a graduate program which culminates in a Master of Arts degree in Education with a field in Library Science. This degree is granted in conjunction with the College of Human Resources and Education and the Graduate School.

The student will be admitted to the graduate program when he has met the following Departmental requirements:

1. A Bachelor's degree from an approved college or university with evidence of 9 semester hours credit in the following Library Science courses or equivalents:

- 101. Basic Reference
- 203. Library Materials for Children
- 223. Cataloging and Classification

2. A broad cultural background with a field of specialization.

3. Evidence of ability to undertake the completion of the Library Science program as well as promise of professional proficiency as shown by previous academic record.

4. A personal interview whenever possible.

Degree Requirements: The candidate for the Master of Arts in Education degree with a field in Library Science will be required to complete 30 semester hours of graduate study consisting of:

(1) a. Eighteen graduate hours in Library Science, with an average of B, of which at least 3 hours will be in courses of "300" number; or,

b. Twelve graduate hours in Library Science, with an average of B, of which at least 3 hours will be in courses of "300" number, and 6 graduate hours in a related field (with faculty adviser approval) with an average of B.

(2) a. Nine hours graduate courses in Education, with an average of B, Audio-visual Resources and Introduction to Education Research, and 3-6 hours of electives.

b. A 3-hour problem report (Education 360) in some phase of librarianship; thus completing the 30 semester hours necessary for the degree.

Required Courses in Education

Ed. 221—Audio-visual Resources in Education	3	9 hr.
Ed. 301—Introduction to Education Research	3	
Ed. 360—Problem in Education (Library Science)	3	

Electives from this group

Ed. 271—Educational Measurements	3	3-6 hr.
Ed. 322—Organizing Programs of Audio-visual Instruction	2	
Ed. 331—Philosophy of Education	3	
Ed. 335—Elementary School Curriculum	3	
Ed. 336—Secondary School Curriculum	3	
Ed. 339—Public-school Organization and Administration	3	
Ed. 348—Human Development and Behavior	3	
Ed. 385—History of Education	3	
C&G 373—Basic Course in Guidance	3	

Library Science

- 203. **Library Materials for Children.** I, II, S. 3 hr. A survey of the development of of children's literature with emphasis on modern books.
- 205. **Selection of Books and Related Materials for the Secondary School Library.** A survey of adolescent literature and other library materials adapted to the needs of high school students.
- 207. **Organization and Administration of the Instructional Materials Center in the Secondary School.** I, S. 3 hr. PR: Lib. Sci. 205, 223, for school librarians.

A study of organization and administration, including planning, equipment, routines, and schedules, and the role of the librarian in the instructional program.

221. **Public and Regional Library Service.** S. 3 hr. PR: Consent. Principles governing the administration of tax-supported public libraries and the development of larger units of service.
222. **Field Practice.** I, S. 3 hr. Practical experience in a variety of public, school, and special libraries under the supervision of experienced librarians. 100 clock hours must be completed by the student. PR: Lib. Sci. 1 or 101, 203 or 205, 207, 223.
223. **Cataloging and Classification.** I, S. 3 hr. Basic principles and problems of cataloging and classification combined with practical experience in processing the various types of books and materials. Problems peculiar to the teacher-librarian will be considered.
224. **History of Books and Libraries.** I, S. 3 hr. A survey course, including the development of the book from early manuscript form, history of printing, printers, book illustration, bindings, and the library and its development.
225. **Books and Reading for Adults.** II, S. 3 hr. Reading and evaluation of representative books in broad subject fields.
226. **Literature of the Social Sciences.** II, S. 3 hr. PR: Consent. An approach to the selection and use of books and materials in the social sciences.
227. **Literature of the Humanities.** II, S. 3 hr. Bibliographical and other reference sources in the major subject areas of the humanities, including religion, philosophy, fine arts, music, and literature.
228. **Literature of Sciences and Technology.** II, S. 3 hr. PR: Consent. A course designed to give the student a good working knowledge of the increasingly complex literature of science and technology.
230. **Library Resources for the School Curriculum.** II. 3 hr. Broadened experiences in both library and outside resources that lend themselves to curriculum enrichment, including guidance, remedial reading, text books, community resources, all phases of audio-visuals, etc. Presented to elementary and secondary teachers as well as librarians to help them give more effective services.
235. **Organization and Administration of the Instructional Materials Center in the Elementary School.** II, S. 3 hr. PR: Lib. Sci. 223 for school librarians. Includes planning quarters, selection, acquisition and organization of books and other materials, supervision of library assistants, relations with faculty, administration, and community.
304. **Advanced Cataloging and Classification.** II, S. 3 hr. PR: Lib. Sci. 223.
309. **Seminar.** I or II, S. 3 hr.
310. **Special Topics.** 3 hr. A thorough study of some phase of library science based on the needs and interest of the individual.
311. **Problem Report.** (Ed. 360). 3 hr. PR: 6 hours of Education courses, Lib. Sci. 309.

MATHEMATICS

The Department of Mathematics offers the Master of Arts and the Master of Science degrees, the Master of Arts degree being considered the predoctoral degree. The Master of Science degree offers more flexibility for those students who expect to enter the teaching field or who plan to become research assistants in industry, research laboratories, statistics centers, computing centers, the actuarial field, and other areas requiring specialized training in mathematics. Students completing this degree will not be recommended for continuation to the Ph.D. degree, nor will they be given support for a mathematics appointment in college.

Upon application for admission to Graduate School for the study of mathematics the student should make available to this Department his score on the Graduate Record Examination in Advanced Mathematics. If the student has not taken this examination he must do so at its first offering during his first semester of study. It is the responsibility of the student to acquaint himself with the requirements of the Graduate School, particularly with respect to deadlines for applying for degree-completing examinations, etc.

Students who expect to do graduate work in mathematics must have completed the equivalent of the mathematics requirements for an undergraduate major at West Virginia University. By permission, deficiencies in preparation may be made up after admission to the department by the completion of recommended undergraduate courses. It may be possible for a student to remove deficiencies by taking a comprehensive qualifying examination, the purpose of which is to determine his undergraduate background and to check on his fitness to pursue graduate work in the department. If deficiencies are to be cleared by test, this must be done either prior to his first registration or early in the first semester (or term) in which he enrolls.

Students are expected to maintain at least a 3.0 (B) average in their mathematics courses and to present at least a 3.0 (B) average in all course work offered in fulfillment of the degree requirements.

Departmental Requirements and Policy

Candidates for the Master of Arts degree (prerequisite for doctoral work in mathematics) must complete a minimum of 30 hours credit, of which at least 24 must be in the "300" series of mathematics. At least six hours must be completed in each of three of the following fields: Algebra, Analysis, Geometry, and Topology.

The student should demonstrate proficiency in one foreign language prior to the final semester in which the degree requirements are met. This is done by arranging for the examination with the Foreign Language Examiner. Languages acceptable are: French, German, Russian, Italian. Others may be accepted, if special research and study require a knowledge of them (for example, Greek, Latin, Arabic, Polish, Hungarian, etc.).

A 3.0 (B) average is prerequisite to the writing of the comprehensive examinations in the areas of study, or the taking of the final oral examination.

A thesis, for which 6 hours credit is allowed, is expected. The date for the final oral examination for defense of thesis cannot be set sooner than the twenty-first day following that on which the thesis is placed in the hands of the student's Graduate Advisory Committee.

Candidates for the Master of Science degree must complete a minimum of 30 hours credit. The program will be worked out in conference with the Graduate Adviser's Committee, and will usually include at least 24 hours of courses selected from the "300" series in mathematics. No course work required for the removal of deficiencies may be included in the thirty hours offered for the degree.

Students who wish to do a minor part of their work in an applied area (for example, Physics, Engineering), or related areas in Education, should confer with the Graduate Adviser for prior approval of their Master's program. Cooperation with these departments and divisions is encouraged when the student will be served by this arrangement. The Department of Mathematics approves and promotes cooperation with other divisions of the University in developing graduate programs.

The Department also serves many related fields in that it embodies the areas of Algebra and Topology, Numerical Analysis and Computer Science, Analysis and Applied Mathematics, Probability and Statistics, and a variety of Mathematics Education programs.

Statistics

The Master of Science degree in statistics is an interdepartmental degree administered through the Division of Statistics. Administration of the degree includes certification of candidates, appointment of the representatives of Statistics on students' advisory committees, and setting minimum course requirements and levels of performance for students.

An M.S. degree may be taken in either theoretical or applied statistics; a minimum of 36 hours credit is required for the degree. Students lacking prerequisite courses in mathematics may be required to take additional courses, possibly even lower division courses for which graduate credit cannot be given.

A minimum of 18 hours in statistical methods, applications, and theory are required by the Division of Statistics. A report, for which 3 hours credit may be granted, is also required.

Additional graduate level courses will consist of elective statistics courses, supporting mathematics courses, or courses in the field to which the candidate may wish to apply his statistical knowledge.

Mathematics

- 201, 202. **Combinatorial Analysis.** I, II. 3 hr. PR: One year of calculus. Permutations, combinations, generating functions, principle of inclusion and exclusion, distributions, partitions, compositions, trees, and networks.
206. **Mathematical Logic 2.** I or II. 3 hr. PR: Math. 106. Formalization of the material in the previous term, the concepts of consistency, decidability, and completeness (equivalent to Philosophy 206).
- 208, 209. **Theory of Probability.** I, II. 3 hr. PR: Math. 17. Fundamental theorems. Development of density and distribution functions in the discrete and continuous cases. Classical problems and solutions. Moments, characteristics functions, limit theorems. Applications.
213. **Intermediate Differential Equations.** II. 3 hr. PR: Math. 140, 252 (or 258). Second-order linear equations, Riccati equation, complex variables. Series solutions. Equations of Fuchsian type, hypergeometric equation, confluence of singularities. Classical equations, applications.
214. **Partial Differential Equations.** I. 3 hr. PR: Math. 140. Primarily for engineers and scientists. One-dimensional wave equations, linear second-order equations in two variables, elliptic and parabolic equations, Fourier series, non-homogeneous and higher dimension problems, Sturm Liouville theory, and approximate methods.
215. **Operational Methods in Partial Differential Equations.** II. 3 hr. PR: Math. 140, 252, (or 258). Laplace transformation, properties and elementary applications; problems in partial differential equations; complex variable; problems in heat conduction, mechanical vibration, etc. Sturm-Liouville systems. Fourier transforms.
- 220, 221. **Introduction to Numerical Analysis.** I, II. 3 hr. PR: Math. 17 and Math. 237 or Math. 245 or consent. Approximation of functions, iteration procedures, numerical integration and differentiation, numerical solution of linear and non-linear equations, numerical solutions of ordinary differential equations, error analysis and pitfalls of computation.
- 230, 231. **Theory of Numbers.** I, II. 3 hr. PR: One year of calculus. Introduction to classical number theory, covering such topics as divisibility, the Euclidean algorithm, Diophantine equations, congruences, primitive roots, quadratic residues, number-theoretic functions, distribution of primes, irrationals, and combinatorial methods. Special numbers, such as those of Bernoulli, Euler, and Stirling.
232. **Mathematical Statistics.** II. 3 hr. PR: Math. 17. Discrete and continuous variables; correlation, regression, sampling theory; normal, chi-square, t, and F distributions; significance tests; analysis of variance.
235. **Introduction to Analysis and Topology.** I, II. 3 hr. PR: Math. 17 or consent. A study of sets, relations, functions; cardinal numbers, and orderings. Topological spaces including continuity, convergence, separation, compactness, and connectedness.

236. **Introduction to Algebraic Structures. I, II.** 3 hr. PR: Math. 17 or consent. Basic study of groups, ring, integral domains, fields, and polynomial rings. Special consideration of the real and complex fields and related topics.
237. **Introduction to Linear Algebra. II.** 3 hr. PR: Math. 17 or consent. A study of vector spaces, matrices, determinants, linear transformation, bilinear and quadratic forms, and related topics.
243. **Projective Geometry. II.** 3 hr. PR: Math. 236, 237 or consent. Projective and affine spaces, transformation groups for planes. Introduction to axiomatic plane geometries.
245. **Vector Analysis. I, II.** 3 hr. PR: Math. 17. Primarily for engineers and scientists. Vector algebra, differential operators, curvilinear coordinate systems, Stokes' and Gauss' theorems, applications, linear systems of equations, matrices, determinants, quadratic forms, eigenvalues and canonical forms, and numerical inversions.
247. **Theory of Numbers. S.** 3 hr. PR: Math. 17. Divisibility, distribution of primes, theory of congruences, theory of quadratic residues, arithmetical properties of the roots of unity. Diophantine equations, and the prime number theorem.
- 251, 252. **Introduction to Real Analysis. I, II.** 3 hr. PR: Math. 235 or consent. A study of sequences, limits, continuity, definite integral, convergence, differentiation, differentials, functional dependence, multiple integrals, line and surface integrals, and differential forms.
256. **Complex Variables. II.** 3 hr. PR: Math. 140. Complex numbers, functions of a complex variable, analytic functions, the logarithm and related functions, power series, Laurent series and residues, conformal mapping and applications.
- 257, 258. **Advanced Calculus. I, II.** 3 hr. PR: Math. 140. Primarily for engineers and scientists. Functions of several variables, partial differentiation, implicit functions, transformations; line, surface and volume integrals; point set theory, continuity, integration, infinite series and convergence, power series, and improper integrals.
260. **Advanced Real Calculus. S.** 3 hr. PR: Math. 17. Limits, series, metric spaces. Uniformity. Integrals.
- 261, 262, 263. **Special Topics. I, II, S.** 2-4 hr. Topics in algebra, geometry, and analysis.
- 264, 265. **Foundations in Algebra. S.** 2 hr. PR: Differential and integral calculus, or consent. Not open to students with credit for Math. 236. Introduction to algebraic structures: rings, the integral domain of integers, properties of the integers, fields, polynomials over a field, groups; matrices; linear systems; vector spaces; vector geometry; linear transformations; and linear programming.
- 266, 267. **Foundations of Geometry. S.** 2 hr. PR: Differential and integral calculus, or consent. A study of affine, projective, Euclidean and non-Euclidean geometries.
- 268, 269. **Probability and Statistics. S.** 2 hr. PR: Differential and integral calculus or consent. Finite sample space, measure of the set of outcomes and probability of events, independent trials, functions on the sample space, approximations to the binomial distribution, elementary statistical inference, continuous sample space, limit theorems. Stochastic processes, statistical models, and applications.
- 270, 271. **Introduction to Mathematics for the Elementary Teacher. I, II.** 3 hr. per sem. PR: Math. 56, 57 or consent. Systems of numeration; sets, relations, binary operations, decimal and other base systems; natural numbers, integers, rational numbers, and real numbers with emphasis on the algebraic structure of each; the notions of length, area, and volume; pythagorean theorem; and coordinate geometry. Not open to students with credit for Math. 170, 171.

280. **Introduction to Metamathematics 1.** I. 3 hr. PR: Consent. Survey of the methodology of the deductive sciences with emphasis on the theory of proof and effective operations therein. (Equivalent to Philosophy 280).
281. **Introduction to Metamathematics 2.** II. 3 hr. PR: Math. 280. This course deals with recursive function theory. Godel's proof and associated results. (Equivalent to Philosophy 281).
299. **Seminar in Applied Mathematics.** I, II. 1-12 hr.
- 309, 310. **Group Theory.** I, II. 3 hr. PR: Math. 236 or consent. Elementary group theory; Sylow theory, extended Sylow theory in solvable groups, Burnside's theorem on normal complements, transfer homomorphism. Representation theory. Emphasis throughout on finite groups.
- 311, 312. **Topology.** I, II. 3 hr. PR: Math. 252 or consent. A detailed treatment of topological spaces covering the topics of continuity, convergence, compactness, and connectivity; product and identification spaces, function spaces, and the topology in Euclidean spaces.
314. **Tensor Analysis.** II. 3 hr. PR: Math. 245, 252, (or 258). Vector concept developed from standpoint of algebraic invariants, surface geometry, tensor operators, curvature tensor. Ricci and Bianchi identities, applications of tensors to physical phenomena.
315. **Calculus of Variations.** II. 3 hr. PR: Math. 140, 252, (or 258). Maximum and minimum value of an integral, shortest distance, the brachistochrone problem, surface of revolution of minimum area, conditions for a relative minimum. Applications.
- 320, 321. **Special Functions.** I, II. 3 hr. PR: Math. 140, 252. Operational techniques; generalized hypergeometric functions: classical polynomials of Bell, Hermite, Legendre, Noerlund, etc. Introduction to recent Polynomial systems. Current research topics.
- 322, 323. **Analytic Number Theory.** I, II. 3 hr. PR: Math. 230-231, 236-265. Selected topics in analytic number theory such as the prime number theorem; primes in an arithmetical progression; the Zeta function; the Goldbach conjecture.
- 331, 332. **Theory of Partial Differential Equations.** I, II. 3 hr. PR: Math. 252, or equivalent. Elementary concepts; Cauchy problems; the Cauchy-Kowalewski theorem; general existence theorems; associated surfaces; classification into elliptic, parabolic, and hyperbolic types; conditions required of coefficients for solvability; techniques for solution; distribution theory; and numerical methods.
- 351, 352. **Algebraic Geometry.** I, II. 3 hr. PR: Math. 243, 236. Foundations of affine geometry, the geometry of quadratic forms. Structure of the general linear group, symplectic groups, and orthogonal groups.
353. **Linear Algebra.** II. 3 hr. PR: Math. 237 or consent. Review of theory of groups and fields; linear vector spaces including the theory of duality; full linear group; bilinear and quadratic forms; and theory of isotropic and totally isotropic spaces.
- 354, 355. **Algebraic Theory of Semigroups.** 3 hr. PR: Math. 362-363, or equivalent. Ideal theory, matrix representation of semigroups, decompositions and extensions, simple semigroups, inverse semigroups, congruence relations, recent research.
- 360, 361. **Differential Geometry.** I, II. 3 hr. PR: Math. 236, 243. Elementary differential geometry. Transformation groups. Space curves. Surfaces. Geometry of surfaces.

- 362, 363. **Modern Algebra.** I, II. 3 hr. PR: Math. 236, or consent. Concepts from set theory and the equivalence of the Axiom of Choice. Zorn's Lemma and the Well-Ordering Theorem; a study of the structure of groups, rings, fields, and vector spaces; elementary factorization theory; extensions of ring and fields; modules and ideals; and lattices.
- 364, 365. **Theory of Functions of Complex Variables.** I, II. 3 hr. PR: Math. 252. Number systems, the complex plane and its geometry, fractions, powers, roots and transformations, Holomorphic functions, power series, elementary functions, complex integration, representation theorems, the calculus of residues, analytic continuation and analytic function, Elliptic functions, Holomorphic functions of several complex variables.
- 366, 367. **Algebraic Plane Curves.** I, II. 3 hr. PR: Math. 243. General theory of curves, singularities, associated curves.
- 376, 377. **Theory of Functions of Real Variables.** I, II. 3 hr. PR: Math. 235, 236, 252. Measure. Integration. Topics from functional analysis.
- 378, 379. **Functional Analysis.** I, II. 3 hr. PR: Math. 252 or consent. Linear spaces, seminorms, norms, metrics, Banach spaces, Hilbert spaces, uniform boundedness theorem, the open mapping theorem, the closed graph theorem, Riesz's representation theorem, linear topological spaces, Hahn-Banach Theorem, convergence, convexity, duality, Banach algebras.
380. **Thesis.** I, II. 1-6 hr.
390. **Seminar in Analysis.** I, II. 1-12 hr.
391. **Seminar in Algebra.** I, II. 1-12 hr.
392. **Seminar in Geometry.** I, II. 1-12 hr.
393. **Seminar in Number Theory.** I, II. 1-12 hr.
394. **Seminar in Special Functions.** I, II. 1-12 hr.
395. **Seminar in Topology.** I, II. 1-12 hr.
397. **Research.** 1-15 hr. PR: Consent. The student will be assigned to a member of the staff engaged in research to assist with the investigation of a significant problem. The work of the course will be that assigned to him by the staff member. The student may enroll for research under this course number any number of times approved by his adviser and the Dean of the Graduate School.

Astronomy

216. **Astronomy for Teachers.** S. 3 hr. Introduction to astronomy with special emphasis on the needs of physical science teachers and science club directors. Not open to students with credit for Astronomy 106.
255. **Mathematical Astronomy.** II. 3 hr. PR: Astron. 106, Math. 140. Development of the implications of Kepler's Laws and Newton's Law of Gravitation.

Statistics

201. **Intermediate Statistical Methods.** II. 3 hr. PR: Stat. 101. Extension of basic concepts of statistical models, elementary decision theory, estimation, random variables, one- and two-way classification models, analysis of variance, F-distribution, time series, seasonal and cyclical movements, simple and multiple linear regression and correlation analysis (equiv. to Econ. 256).
211. **Statistical Methods 1.** I, II. 3 hr. PR: Math. 3. Basic concepts of statistical models, distributions, probability, random variables, tests of hypotheses, confidence intervals, regression, correlation, transformation, F and χ^2 distributions, analysis of variance of one- and two-way classification models, multiple range tests, missing plots, and sample size (equiv. to Psychol. 221; and Ed. 221).

212. **Statistical Methods 2.** I, II. 3 hr. PR: Stat. 201, Stat. 211, or Stat. 213. Extension of basic concepts of statistical models, design of experiments, multi-way classification models, factorials, split plot design, simple covariance, orthogonal comparisons, multiple linear and nonlinear regression and correlation analysis, chi-square, and non-parametric statistics (equiv. to Psychol. 215).
213. **Basic Statistical Analysis 1.** I, II. 3 hr. PR: Math. 16. Measures of central tendency and variation, probability, sampling, probability distributions, inference, tests of hypotheses, confidence intervals, analysis of variance, simple linear regression and correlation, and enumeration statistics (equiv. to I.E. 244).
214. **Basic Statistical Analysis 2.** I, II. 3 hr. PR: Stat. 213 or equiv. Single and multi-factor experimental designs; fixed, mixed and random effect models; split plot designs; multilinear and nonlinear regression and correlation analyses; and analysis of covariance (equiv. to I.E. 214).
215. **Statistical Computer Techniques.** II. 2 hr. PR: Math. 110 or I.E. 180 and pre- or corequisite Stat. 212, or consent. Extension of concepts and skills related to using digital computers for statistical analysis. In addition to programming statistical analyses and elementary simulations in the Fortran language, programs available in the Computing Center Statistical Program Library will be utilized.
221. **Design of Experiments.** I. 3 hr. PR: Stat. 212 or Stat. 214. Extension of basic concepts of statistics to the more complicated models and use of samples, design and analysis of experiments over time and space, fractional replications, incomplete block design, cross-over designs, lattice designs, and least squares analysis for designs with unequal subclass numbers.
231. **Sampling Methods.** I. 3 hr. PR: An introductory course in statistics. Methods of sampling from finite and infinite populations, choice of sampling unit, sample survey design, estimation of confidence limits and optimum sample size, and single and multi-stage sampling procedures.
233. **Nonparametric Statistics.** II. 3 hr. PR: An introductory course in statistics. Single sample tests; for related samples, two independent samples, k related samples, k independent samples; and measures of correlation.
241. **Multivariate Methods 1.** I. 3 hr. PR: Stat. 201, Stat. 211, or Stat. 213. Introduction to elementary matrix operations, partial and multiple linear and nonlinear correlation and regression analyses, and introduction to discriminant analysis (equiv. to Psych. 217).
242. **Multivariate Methods 2.** II. 3 hr. PR: Stat. 241 or equiv. This course includes a discussion of the multivariate normal distribution, tests of hypotheses about the sample mean vectors and variance-covariance matrices from a multivariate normal distribution, and analysis of variance of multiple responses in basic statistical designs.
261. **Theory of Statistics 1.** I. 3 hr. PR: Math. 17. Probability and random variables, univariate and multivariate probability distributions, expectations, moment, marginal and conditional distributions, independence, correlation, transformations, and functions of random variables.
262. **Theory of Statistics 2.** II. 3 hr. PR: Stat. 261. Estimation including bias, consistency, efficiency and sufficiency, hypothesis testing, distribution-free problems, order statistics, linear models and analysis of variance and special distributions.
291. **Special Topics.** I, II, S. 2-4 hr. Advanced study of special topics in statistics.
346. **Factor Analysis.** II. 3 hr. PR: Stat. 241. Alternative methods for factor extraction, communalities, rotation in orthogonal and oblique space, and estimation of factors scores (equiv. to Psychol. 318).

361. **Linear Statistical Models 1. I.** 3 hr. PR: Stat. 214 or equiv. and Stat. 262 or consent. Statistical concepts, multivariate normal distribution, distribution of quadratic forms, linear models, general linear hypothesis, polynomial models, functional relationships and regression models (equiv. to I.E. 345).
362. **Linear Statistical Models 2. II.** 3 hr. PR: Stat. 361. Experimental design models, factorial models, incomplete block models, assumptions of experimental design models, and components of variance for fixed, random, and mixed models (equiv. to I.E. 346).

PHILOSOPHY

Acceptance of a student will be based on (1) a Bachelor of Arts Degree with a minimum grade-point average of 3.0; (2) adequate academic aptitude as measured by the Graduate Record Examination; and (3) references from persons who can attest to, and advise on, the applicant's ability to complete the degree program.

The M.A. Degree

To obtain the Master of Arts degree in Philosophy. (1) a minimum of 30 semester hours of course work beyond the Bachelor's Degree is required; (2) a reading knowledge of some language, preferably French or German, is required; (3) a comprehensive examination in the areas of the History of Philosophy, Logic, Ethics and Theory of Knowledge must be passed; (4) a thesis must be submitted, or, at the discretion of the Department of Philosophy, a written examination in the candidate's special field must be passed; and (5) an oral examination must be passed.

A grade no lower than "B" in all courses taken at the graduate level is required.

Philosophy

206. **Mathematical Logic 2. II.** 3 hr. PR: Philos. 106 or consent. Formalization of the material in the previous term, the concepts of consistency, decidability, and completeness (equiv. to Math. 206).
214. **Theory of Knowledge. I or II.** 3 hr. PR: Philos. 106 and consent. Advanced topics in the theory of knowledge.
218. **Ethical Theory. I or II.** 3 hr. PR: Philos. 108 or consent. Selected, complete ethical theories and/or special problems in meta-ethics.
221. **Contemporary Philosophies of Continental Europe. I or II.** 3 hr. PR: Philos. 114. A study of the various European thinkers of the present day.
223. **Philosophy of Religion. I or II.** 3 hr. PR: Philos. 123 or consent. Advanced topics in the philosophy of religion.
230. **Aesthetic Theories. I or II.** 3 hr. PR: Philos. 130 or consent.
241. **Introduction to Analytic Philosophy. I or II.** 3 hr. PR: Philos. 102, 106. Contemporary schools of analytic philosophy.
250. **Social and Political Philosophy. I or II.** 3 hr. PR: Philos. 150. Advanced topics in social and political philosophy.
253. **Philosophy of Mathematics. I or II.** 3 hr. PR: Philos. 106 or consent. Contemporary viewpoints in the foundations of mathematics.
258. **Philosophy of Science I. I or II.** 3 hr. PR: Philos. 106 or consent. An analysis of the conceptual and methodological foundations of science.
259. **Philosophy of Science II. I or II.** 3 hr. PR: Philos. 258 and Philos. 106 or consent. Further topics including induction, confirmation and cognitive status of scientific theories.
264. **Empiricism. I or II.** 3 hr. PR: Philos. 101, 102. Locke, Berkeley, and Hume.

266. **Metaphysics.** I or II. 3 hr. PR: Philos. 166 or consent. Advanced topics in metaphysics.
268. **Rationalism.** I or II. 3 hr. PR: Philos. 101, 102. Descartes, Spinoza, and Leibniz.
270. **Greek Philosophy.** I or II. 3 hr. PR: Philos. 101 and Philos. 102 or consent.
272. **Philosophy of Law.** I or II. 3 hr. PR: Philos. 108 or Philos. 150. Selected topics in foundations and procedures of law.
278. **Medieval Philosophy.** I or II. 3 hr. PR: Philos. 101, 102. A study of the major philosophies of the western world from Plotinus to Descartes.
280. **Introduction to Metamathematics I.** I or II. 3 hr. PR: Consent. Survey of the methodology of the deductive sciences with emphasis on the theory of proof and effective operations therein (equiv. to Math. 280).
281. **Introduction to Metamathematics II.** I or II. 3 hr. PR: Philos. 280. This course deals with recursive function theory. Godel's proof and associated results (equiv. to Math. 281).
283. **Philosophy of History.** I or II. 3 hr. Typical theoretical problems such as the nature of historical explanation, relativism, and the status of speculative principles of history.
285. **Philosophy of Language.** I or II. 3 hr. PR: Philos. 106 or Philos. 104. An analysis of the nature of meaning and language.
287. **Philosophy of Mind.** I or II. 3 hr. PR: Philos. 241 or Philos. 114, or consent. Typical problems in this course have to do with whether there are minds, the difference between minds and bodies, other minds, and the analysis of mental concepts.
289. **Advanced Topics in Logic.** I or II. 3 hr. PR: Philos. 206 or Philos. 280.
290. **Seminar: Selected Topic.** I or II. 3 hr. PR: Consent.
291. **Seminar: Selected Topic.** I or II. 3 hr. PR: Consent.
292. **Seminar: Selected Author.** I or II. 3 hr. PR: Consent.
293. **Seminar: Selected Author.** I or II. 3 hr. PR: Consent.
299. **Philosophical Questions.** I or II. 1-12 hr. PR: Consent.
- *301. **Induction and Rational Belief.** I or II. 3 hr.
302. **Philosophy of Science.** I or II. 3 hr.
303. **Theory of Knowledge.** I or II. 3 hr.
304. **Symbolic Logic.** I or II. 3 hr.
305. **History of Philosophy.** I or II. 3 hr.
306. **Metaphysics.** I or II. 3 hr.
307. **Seminar.** I. 3 hr.
308. **Seminar in the Philosophical Foundations of Logic.** 3 hr.
309. **Problems in Philosophy.** I or II. 3 hr.
310. **Ethics.** I or II. 3 hr.
311. **Philosophical Foundations of Psychology.** I or II. 3 hr.
312. **Thesis.** 2-6 hr.
316. **Foundations of Set Theory.** I or II. 3 hr.

*All courses in the 300 series require departmental consent for admission.

PHYSICS

A candidate for the degree of Master of Science in Physics should have had introductory work in mechanics, electricity, and modern physics as acquired in undergraduate courses in physics or in related sciences at an approved college or university. Physics Seminar and research leading to a thesis are required. The remaining credit to make a minimum total of 30 semester hours is chosen from the graduate courses in physics, mathematics, and other suitable sciences as approved by the student's adviser.

Applicants for the degree of Doctor of Philosophy will be required to pass a preliminary admission examination after one year of graduate work, demonstrate reading proficiency in two languages (French, German, or Russian), complete a minimum of 45 hours of specified course work, pass a qualifying examination, gain approval of his dissertation, and pass a final oral examination.

Physics

- 201, 202, 203, 204. **Special Topics.** I, II. 1-3 hr. per sem.
213. **Introductory Electronics.** S. 3 hr. PR: 1 year college physics. Primarily for education majors; not for graduate credit for science majors.
218. **Dynamic Meteorology.** II. 3 hr. PR: Physics 117 or equiv. and calculus. Dynamics of lower atmosphere relating to transport and dispersion of foreign matter.
221. **Optics.** II. 3 hr. PR: Calculus, Physics 11, 102, or equiv. Work with optical instruments, spectrometry, interferometry, and polarization.
- 225, 226. **Modern Physics.** I, II. 3 hr. per sem. PR: Calculus, Physics 11, 102, or equiv. Particle analysis, phenomena connected with the structure of the atom and nucleus. Not open to those who have credit for Physics 125 and 126.
- 231, 232. **Theoretical Mechanics.** I, II. 3 hr. per sem. PR: Calculus, Physics 11, 102, or equiv. Theorems and problems in intermediate mechanics.
- 233, 234. **Introductory Electricity and Magnetism.** I, II. 3 hr. per sem. PR: Calculus, Physics 11, 102, or equiv. Electrostatics, magnetostatics, introductory electrodynamics, and applications.
- 241, 242. **Mechanics Laboratory.** I, II. 1 hr. To supplement Physics 231, 232.
- 243, 244. **Electricity Laboratory.** I, II. 1 hr. To supplement Physics 233, 234.
- 245, 246. **Modern Physics Laboratory.** I, II. 1 hr. To supplement Physics 225, 226.
- 247, 248. **Physics Seminar.** I, II. No credit. Required of Junior, Senior, and Graduate physics majors.
249. **Optics Laboratory.** II. 1 hr. To supplement Physics 221.
251. **Introductory Quantum Mechanics.** I. 3 hr. PR: Physics 225, 226 or equiv. An introduction to the concepts and methods of elementary quantum treatment in physics.
254. **Outline of Modern Physics.** S. 3 hr. PR: 1 year of college physics, 1 year of college mathematics. Selected topics in modern physics. Primarily for education majors; not open to physics majors.
- 255, 256. **Workshop for Physics Teachers.** SI, SII. 3 hr. PR: 1 year of college physics, 1 year of college mathematics. Techniques of apparatus construction and demonstration. Primarily for education majors; not open to physics majors.
257. **Photography.** SI. 3 hr. PR: 1 year of physics or equiv. Primarily for education majors; not open to physics majors.
258. **Light.** SII. 3 hr. PR: 1 year of physics or equiv. Primarily for education majors; not open to physics majors.

- 261, 262. **Molecular Physics.** I, II. 3 hr. per sem. PR: Physics 225, 226. Molecular spectra and molecular structure.
- 271, 272. **Solid State Physics.** I, II. 3 hr. per sem. PR: Physics 225, 226. Theoretical concepts required for the understanding of the physical properties of simple crystalline solids.
283. **Thermodynamics.** I. 3 hr. PR: Calculus, Physics 11, 102, or equiv. Application of fundamental laws of thermodynamics to physical systems.
284. **Kinetic Theory.** II. 3 hr. PR: Calculus, Physics 11, 102, or equiv. Application of Boltzmann statistics to physical systems.
- 287, 288. **Introduction to Mathematical Physics.** I, II. 3 hr. per sem. PR: Calculus, Physics 11, 102, or equiv. Boundary value problems in vibration, heat conduction, hydrodynamics, special relativity.
- 325, 326. **Atomic and Molecular Physics.** I, II. 3 hr. PR: Physics 225, 226 or equiv. Treatment of these aspects of modern physics at a level beyond and in more detail than that of intermediate modern physics.
- 331, 332. **Advanced Classical Mechanics.** I, II. 3 hr. PR: Calculus, Physics 231, 232. Lagrangian and Hamiltonian formulations of mechanics, Hamilton-Jacobi theory, small oscillations.
- 333, 334. **Advanced Electricity and Magnetism.** I, II. 3 hr. PR: Physics 233, 234, and differential equations. Wave propagation, electrodynamics of charged particles.
- 341, 342. **Research Seminar.** I, II. 3 hr. PR: Consent. Discussion of problems encountered in particular fields of research, and their relation to other areas of physics.
- 351, 352. **Quantum Mechanics.** I, II. 3 hr. per sem. PR: Physics 225, 226. Schrodinger's equations, hydrogen atom, perturbation, molecular forces.
353. **Advanced Quantum Mechanics.** I. 3 hr. PR: Physics 351, 352. Study of relativistic theory, many electron systems, introduction to quantum electrodynamics.
360. **Nuclear Physics.** I. 3 hr. PR: Physics 225, 226. Outline of modern treatment of nuclear theory and experimental techniques.
- 363, 364. **Advanced Nuclear Physics.** I, II. 3 hr. per sem. PR: Physics 225, 226. Theory of nuclear forces, transformation, energy levels.
- 371, 372. **Advanced Solid State Physics.** I, II. 3 hr. per sem. PR: Physics 271, 272, 351. Detailed discussion and quantum treatment of topics of solid state physics.
383. **Statistical Mechanics.** II. 3 hr. per sem. PR: Physics 283, 252. Classical statistics, Boltzman, F-D, and B-E statistics, theory of fluctuations.
- 397, 398. **Research.** I, II. 1-6 hr. per sem. PR: Consent.

POLITICAL SCIENCE

The graduate program in political science at West Virginia University extends through the Doctor of Philosophy degree. With reference to departmental objectives, the emphasis is placed upon more extensive and intensive training than is possible on the undergraduate level. This involves: (1) the development of a broader knowledge of the literature of political science; (2) some degree of specialization in one of the major areas of the disciplines; and (3) training in the identification and analysis of problems in governmental theory and practice. Graduate work in political science contributes to a general education and provides the foundation for more advanced work in the field. Leading professional possibilities for political science majors include teaching, the public service, and preparation for the legal profession.

The Degree of Master of Arts

Eligibility. Regular applicants for the Master of Arts degree should present a minimum of 12 semester hours of undergraduate credit in political science and at least 6 additional hours in some cognate field, including history, economics, sociology, psychology, or social work. Students who do not meet the minimum requirements may, after consultation with the adviser, be admitted conditionally. In addition, a grade-point average of 2.5 should have been maintained as an undergraduate.

"Special" graduate students who are not working for an advanced degree may be admitted to courses for which they can satisfy the prerequisites.

Course Requirements. Admission to candidacy for the Master of Arts degree in political science is conditioned upon the completion of at least 30 hours of graduate work including a thesis. The candidate should present 18 semester hours of graduate course work in political science and 6 hours of similar work in a cognate field, such as economics, history, sociology, psychology, social work or education. Exceptions to this general rule may be made by the departmental adviser in the case of students with an inadequate background in political science who transfer from other institutions or from other departments in West Virginia University. Normally the thesis will carry 6 hours credit. A reading knowledge of a foreign language is highly desirable.

Thesis and Final Examinations. In his graduate program, the student will write a thesis on a subject falling within his field of specialization. Before undertaking a thesis the student must have passed a two-hour written examination. Fulfillment of the thesis requirement includes the following steps: (1) selection of a problem or topic for research in the problem area; (2) extensive reading and collection of data in the problem area; (3) organization, analysis, and evaluation of the data; (4) writing the thesis in correct form; (5) acceptance of the completed thesis by a committee composed of at least three faculty members, one of whom shall not be a member of the Department of Political Science, and (6) passing an oral or written examination or both, administered by the committee on the thesis and the major and minor fields.

Research on the thesis project will be done under the supervision of a staff member in whose field or specialization the thesis problem falls.

Students who fail to pass the final examination may appear for a second examination not earlier than the semester following that in which the first examination was given. It is contrary to departmental policy to give a third examination.

The Degree of Doctor of Philosophy

To gain admission to the program leading to the Doctor of Philosophy degree applicants must have completed the requirements for a master's degree, or the equivalent, at an approved institution as well as have demonstrated a capacity for graduate work in the Graduate Record Examination.

The program of courses will depend upon the individual needs of the student and the extent of his previous training in political science and related fields. Work leading to the doctoral degree consists of a minimum of three full years of graduate study—at least 60 semester hours after the bachelor's degree, in addition to research for the dissertation. Credits completed for a master's degree may be included in the doctoral program, with the exception of research credit granted for the master's thesis. Only credits with a grade of B or better in political science courses and C or better in the minor are accepted. A minimum of 36 hours or its equivalent in residence in full-time graduate study at West Virginia University is required.

With the approval of his adviser, a prospective candidate selects: (A) four major areas in the field of Political Science from the following six offered by the Department: (1) American National, State and Local Government; (2) Politics and Policy Development; (3) Public Administration; (4) Foreign and Comparative Government; (5) International Relations, Organizations, and Law; and (6) Political Theory; and (B) a minor area in a related field. At least one year prior to the conferring of the degree and after maintaining at least a 3.0 average in the major field and a 2.0 average in the minor, a prospective candidate is formally admitted to candidacy for the Doctor's degree upon satisfactorily passing written and oral examinations in the

four major areas and the minor. To be eligible for these examinations, the prospective candidate must have demonstrated competency in two languages other than English (normally French and German) through examinations conducted by the language department. Competency in statistics as evidenced by six hours with a grade of "C" or better in 200 or 300 level statistics courses may be substituted for one language.

Upon admission to candidacy for the Doctor of Philosophy degree, the candidate must select a topic for a dissertation under the direction of his adviser, complete a dissertation which makes a contribution to knowledge in the candidate's area of concentration, and pass a final examination based primarily upon the dissertation. After successful completion of this final examination, the candidate will be recommended for the degree.

Political Science

200. **Research Materials and Techniques in Political Science. I, II.** 3 hr. A study of basic source materials in political science and of the techniques and methods of governmental research. Required of graduate majors.
210. **American Political Institutions. I.** 3 hr. PR: Pol. Sci. 2 or consent. Development of the Constitution, Congress, the Presidency, and the Supreme Court as institutions with special attention to current problems and issues.
211. **Problems of American National Government. II.** 3 hr. PR: Pol. Sci. 2 or consent. This course is intended to give recognition to the major contemporary problems of government. Extensive reading of background materials as well as current literature in the field.
213. **American Constitutional Law. I.** 3 hr. PR: Pol. Sci. 2 or consent. Basic principles of American constitutional law as developed through interpretation with special emphasis on constitutional theories and national development. Primarily for seniors and graduate students.
214. **Civil Rights and Liberties in the United States. II.** 3 hr. PR: Pol. Sci. 213 or consent. Study of the scope and meaning of civil liberty guarantees in the United States Constitution, as illustrated by cases involving original constitutional provisions, the federal Bill of Rights and Civil War Amendments with special attention to the rule of law; free speech, press, religion, assembly, and petition; personal security; racial discrimination; and the labor problems.
215. **American Constitutional Development I. I.** 3 hr. PR: Pol. Sci. 2 or consent. A survey of American constitutional development, with special emphasis on the origins of constitutionalism here; liberty vs. government; mixed government; separation of powers; the problem of federalism and the Philadelphia Convention of 1787; the Marshall court and establishment of judicial review; Federalist vs. States Rights construction of the Constitution; Jacksonian influences; the Taney Court prelude to the Civil War, secession, and conflict, heralding constitutional change.
216. **American Constitutional Development II. II.** 3 hr. PR: Pol. Sci. 2, 215 or consent. Continuation of a survey in American constitutional development, with special attention to reconstruction, the Supreme Court, and the Fourteenth Amendment; *laissez-faire* and the commerce clause; stirrings of reform toward a constitutional revolution under the New Deal; changing federal-state relationships; the impact of war upon constitutional interpretation; an expanding role for the president in domestic matters and foreign relations; the Warren court and triumph for libertarian activists over judicial restraintists in an era of civil liberties.
218. **Government and Business. II.** 3 hr. PR: Pol. Sci. 2 or consent. An examination of government regulations of the economy dealing with the origin and development of public policies, constitutional and political basis of regulation, relationships between political and economic institutions and processes, and an evaluation of the consequences of regulatory policies.

221. **West Virginia Government and Administration.** I, II. 3 hr. A study of the organization and operation of the state government of West Virginia.
225. **Municipal Government.** I. 3 hr. Legal basis, structure, operation, and problems of municipal government and municipal relations with other governmental units.
226. **Problems of State and Local Government.** II. 3 hr. An examination of current problems of state, county, and municipal governments. Students are expected to have completed Pol. Sci. 120 or its equivalent.
231. **History of Political Parties.** I. 3 hr. An examination of the growth of political parties in the United States. Analysis of issues in presidential campaigns as they relate to political party development. Offered in odd-numbered years.
232. **Public Opinion and Propaganda.** II. 3 hr. Analysis of techniques of sampling and measuring public opinion; detection of propaganda; the nature of propaganda and methods of the propagandist. Offered in alternate years.
233. **Current Political Issues.** I. 3 hr. An examination of political party platforms and the major issues of the political campaign. Students will be expected to examine background materials thoroughly. Offered in even-numbered years.
234. **The Legislative Process.** II. 3 hr. Structure and organization of legislative bodies. Powers of legislature. Detailed study of law-making procedures. The influence of outside forces. Offered in alternate years.
241. **Administrative Organization and Management.** I. 3 hr. PR: Pol. Sci. 140 or consent. Analysis of governmental administrative organization and reorganization and of such management functions as leadership, planning, coordination, public relations, and management improvement.
243. **Public Personnel Administration.** II. 3 hr. PR: Pol. Sci. 140 or consent. A survey of public personnel administration with particular attention to the merit system concept, career staffing, classification and salary administration, selection, manpower utilization, training, the rights and duties of employees, and the relationship between management and personnel specialists. Emphasis is given to psychological and human relations aspects of the work situation with attention to role and status, motivation, leadership, employee relations, and supervisor-subordinate interaction.
244. **Administrative Law and Regulations.** II. 3 hr. PR: Pol. Sci. 140 or consent. Study of the law of administration, primarily by the case method, covering administrative powers, procedure in administrative adjudication and rule-making, discretion, judicial control, and administrative liability. Offered in alternate years.
245. **Public Administration and Policy Development.** II. 3 hr. PR: Pol. Sci. 140 or consent. Analysis of decision-making and policy development in the administrative process by the case method.
246. **Comparative Public Administration.** II. 3 hr. A survey of the theory and practice of public administration in diverse cultures and national political systems.
250. **Comparative Government.** I. 3 hr. A comparative study of modern political institutions with particular attention to European constitutional government and politics.
251. **Modern Dictatorships.** II. 3 hr. Politically undemocratic government. Provides background of dictatorships generally, followed by treatment of several modern dictatorships.
252. **British Government and Politics.** II. 3 hr. Intensive study of British government with emphasis upon both internal and external policies, primarily during the twentieth century. Offered in alternate years.

253. **The Commonwealth of Nations. II.** 3 hr. An analysis of the political relationships between the members of the Commonwealth and a comparative study of the governments of the Dominions and particular reference to Canada and Australia.
254. **Governments of Asia. I.** 3 hr. A survey of contemporary politics and governments of Asia.
255. **Governments of Latin America. II.** 3 hr. A comparative study of the major nations of Latin America.
256. **Governments of the Middle East. I.** 3 hr. An examination of governments and political forces of the Middle East.
257. **Governments of Southeast Asia. II.** 3 hr. Survey of political institutions and governmental processes of the Southeast Asian countries with a special emphasis on the analysis of contemporary political problems of the governments surveyed.
258. **Politics of Africa. I.** 3 hr. A survey of the historical legacies and current political processes of tropical African countries designed primarily for secondary-level social studies teachers who are pursuing graduate training.
259. **Political Tour of Europe. Summer.** 6 hr. PR: Pol. Sci. 1 and 2 or consent. Selected important countries of Europe with lectures and discussion on the governments and politics of these countries. Attention is given to the European Common Market also. Includes interviews with party officials, legislators, civil servants, municipal officials, and newspapermen.
261. **International Organization. I.** 3 hr. Emphasis will be placed upon agencies created since the close of World War II. Some reference to development of international law and League of Nations.
262. **Specialized Agencies of the United Nations. II.** 3 hr. A detailed treatment of the specialized agencies and related institutions.
263. **Public International Law. I.** 3 hr. Law governing relations among nations, including development of rules, means of enforcement, and conflicts between theory and practice.
264. **Conduct of American Foreign Relations. I.** 3 hr. Basic concepts about and factors influencing the decision-making process and the conduct of United States foreign policy, with special attention to the problems of ends and means of a democracy, pressure interest groups (i.e., the military-industrial complex and the administrative bureaucracy); recent theories, analytical tools, and methodology in the problem areas of conflict-resolution, nonconsensus situations, and inter-nation influence; regional patterns, problems, and prospects of United States policy in Europe, Africa, Asia, the Middle East, and the Soviet bloc since 1945.
265. **Basic Factors in Power Politics. II.** 3 hr. PR: Pol. Sci. 2 or consent. Analysis of factors of power in the nation-state system. Evaluation of nationalism and concepts of national interest in modern world politics.
266. **Soviet Foreign Policy. I.** 3 hr. PR: Pol. Sci. 150 or 160 or consent. Basic concepts about and factors influencing choice in the formulation and execution of Soviet foreign policy; the development and present patterns in Soviet foreign relations with key states and the United Nations; possible problems and prospects in further Soviet relations.
267. **Latin America in International Affairs. II.** 3 hr. PR: Pol. Sci. 160 or 255 or consent. Survey of the relations of Latin American States among themselves, with the United States of America, with the United Nations, with regional organizations, and with non-Western States. Analysis in depth of the Monroe Doctrine and its corollaries, and the Inter-American system.

268. **Inter-State Conflict in International Affairs.** II. 3 hr. PR: Pol. Sci. 160 or consent. The study of conflict in inter-state relations, in particular armed conflict between nations. Attention to the role of force, the impact of modern technology and nuclear weaponry, theoretical and research approaches to the causes and nature of conflict, and different modes of conflict control and resolution.
272. **Recent and Contemporary Political Thought.** I. 3 hr. An examination of integral liberalism and the forces leading to the decline of liberalism and a critical analysis of the Fascist and Communist ideologies with their threat to the traditions of western civilization embodied in Christianity and conservatism.
273. **American Political Theory.** II. 3 hr. PR: Pol. Sci. 171 or consent. A survey of major political ideas and their influence upon American society and government from the seventeenth century to the present. Offered in alternate years.
274. **Problems in Contemporary Political Thought.** II. 3 hr. An intensive study of current trends in political thought through examination of the works of contemporary writers. Offered in alternate years.
290. **Socio-Politics of Africa.** I. 3 hr. PR: Pol. Sci. 1, 2, three hours of comparative government and three hours of sociology or anthropology, or consent. A comparative inquiry into political behavior and its social bases in tropical Africa, with particular reference to eastern and central Africa.
291. **Leadership and Authority in Africa.** II. 3 hr. PR: Pol. Sci. 1, 2, three hours of comparative government and three hours of sociology or anthropology, or consent. A comparative study of traditional, colonial, and contemporary political leadership and authority patterns in Africa south of the Sahara.
294. **The Theory of Political Development.** I. 3 hr. PR: Pol. Sci. 1, 2, three hours of comparative government and three hours of sociology or anthropology, or consent. A survey of contemporary theories concerning political change and the relationship of political change to economic and technological development, with particular reference to the new nations.
295. **The Politics of Planned Development.** II. 3 hr. PR: Pol. Sci. 294 or consent. A comparative study of the political aspects of directed economic and technological change, with special reference to the politics of national development planning and the development process.
- 300, 301. **General Seminar in Political Science.** I, II. 1 hr. each. Open to properly qualified students in conjunction with Directed Reading and Research Courses for the presentation of papers for critical consideration; some attention will be given to methodology and bibliography.
- 310, 311. **Directed Reading and Research in American National Government.** I, II. 1-15 hr. per sem., students may enroll more than once.
314. **Seminar in American National Government.** I. 3 hr. PR: Consent.
- 320, 321. **Directed Reading and Research in State Government.** I, II. 1-15 hr. per sem., students may enroll more than once.
324. **Seminar in State and Local Government.** I. 3 hr. PR: Consent.
- 325, 326. **Directed Reading and Research in Local Government.** I, II. 1-15 hr. per sem., students may enroll more than once. PR: Pol. Sci. 225 or consent.
- 330, 331. **Directed Reading and Research in Politics.** I, II. 1-15 hr. per sem., students may enroll more than once. PR: Pol. Sci. 130 or consent.
334. **Seminar in Politics and Policy Development.** I. 3 hr. PR: Consent.
335. **Legislative Internship.** II. 6 hr. PR: One semester graduate study in political science. (Offered odd years.)
344. **Seminar in Public Administration.** II. 3 hr. PR: Consent.

- 346, 347. Directed Reading and Research in Public Administration. I, II. 1-15 hr. per sem., students may enroll more than once. PR: Pol. Sci. 140 or consent.
- 351, 352. Directed Reading and Research in Comparative Government. I, II. 1-15 hr. per sem., students may enroll more than once.
354. Seminar in Comparative Government. II. 3 hr. PR: Consent.
- 361, 362. Directed Reading and Research in International Relations. I, II. 1-15 hr. per sem., students may enroll more than once.
364. Seminar in International Relations. II. 3 hr. PR: Consent.
374. Seminar in Political Theory. II. 3 hr. PR: Consent.
- 375, 376. Directed Reading and Research in Political Theory. I, II. 1-15 hr. per sem. Students may enroll more than once.
380. Thesis. I, II. 2-15 hr..

PSYCHOLOGY

Admission. Acceptance of the student will be based on: (1) adequate academic aptitude at the graduate level as measured by the Graduate Record Examination; (2) a minimum average grade of 2.5 (C+); (3) personal qualities in the applicant which are predictive of success in graduate study and satisfactory professional placement after graduation; (4) adequate preparation in the biological and social sciences, experimental psychology, and statistics. By permission, deficiencies in preparation may be made up after admission to the department. Students are expected to maintain a 3.0 (B) average in their psychology courses during the first graduate year, and to present a final 3.0 average in all psychology courses attempted.

The M.A. Degree. Two alternative programs leading to the Master's degree are offered.

Thesis Option. This requires a minimum of 30 graduate credits and presentation of a thesis reporting the results of experimental research. Competence in basic areas of psychology is stressed. This option must be elected by students admitted to the Ph.D. program.

Non-Thesis Option in Clinical Psychology. This requires a minimum of 48 graduate credits in specified courses, providing more intensive and specialized training for professional service than does the thesis option. Students completing this option will not be recommended for continuation to the Ph.D. degree.

Each of the Master's programs requires the student to demonstrate competence in basic areas of psychology after one year of full-time graduate study, and to pass an oral examination over his specialty area and related matters at the end of his course.

The Ph.D. Degree. The doctoral programs aim to prepare a small number of well-qualified psychologists for three types of careers: (1) teaching and research in experimental psychology, (2) teaching and research in personality and social psychology, (3) teaching and research in life-span developmental psychology, and (4) teaching, research and practice in clinical psychology. The clinical program requires a 12-months internship in an approved setting. The career teacher program requires an academic year of supervised college teaching. A year of research field placement is taken by most students in the life-span developmental and personality-social programs.

Students are accepted for study toward the Ph.D. objective upon entry into the department. They are formally admitted to doctoral study only after completion of the Master's degree or its equivalent and may be subject to a screening examination to determine their readiness for doctoral work. After about 30 hours of work in residence beyond the M.A. degree the student will be admitted to a comprehensive preliminary examination in which he must demonstrate a reading knowledge of one foreign language, competence in his major area of specialization, and a knowledge of such other areas of psychology as may be required of all students.

Upon passing the preliminary examination, the student will be formally promoted to candidacy for the doctorate. He will then be assigned a committee which will direct his further course work and his dissertation research, and will approve his internship setting.

After completion of a satisfactory dissertation and all other requirements, the candidate will take a final examination, written or oral, over his major and minor specialties and the dissertation.

Psychology

202. **Job Analysis.** I or II. 3 hr. PR: Psych. 203 or consent. Instruction and supervised practice in the preparation of job analysis and in the use of occupational descriptions. Especially designed for students in psychology, guidance, engineering, management, and rehabilitation counseling.
203. **Personnel Psychology.** I or II. 3 hr. PR: Psych. 1 and Stat. 101 or equiv. Application of psychological principles and techniques to the problems of measurement and prediction of proficiency in industry and society. Topics include proficiency measurement, personnel selection by test and interviews, conditions of work and productivity, engineering psychology, work methods, and safety.
211. **Statistical Methods in Psychology.** I. 3 hr. Basic concepts of statistical models, distributions, probability, random variables, tests of hypotheses, confidence intervals, regression, correlation, t , F , and X^2 distributions, completely randomized analysis of variance. (Equivalent to Stat. 211. and Educ. 211.)
212. **History of Psychology.** I or II. 3 hr. PR: Psych. 1. Traces the development of the science and concepts of psychology from their origin in philosophy, physiology, and medicine up to the modern era.
213. **Directed Studies.** I, II. 1-3 hr. per sem.
214. **Theory of Tests and Measurement.** I. 3 hr. PR: Elementary statistics or consent. Theory underlying psychological scaling, mathematical models, classical psychometrics. Includes introduction to concepts of reliability, validity, correlation and regression, multivariate analysis procedures.
215. **Analysis of Variance.** II. 3 hr. PR: Psych. 211 or equiv. Extension of basic concepts of statistical models, design of experiments, multiway classification models, factorials, split plot design, simple covariance, orthogonal comparisons, multiple linear and nonlinear regression and correlations analysis, and non-parametric statistics. (Equivalent to Stat. 212 and Educ. 212.)
217. **Multivariate Analysis.** I or II. 3 hr. PR: Psych. 211 or 214 or equiv. Correlational methods in psychology with application to typical research problems. Includes simple matrix algebra, multiple correlation, discriminant analysis, and introduction to factor analysis.
221. **Sensory Processes.** I or II. 3 hr. PR: Psych. 121 or 122. Psychophysics of vision and audition are analyzed and related to current theories. Methods of research in sensory processes are reviewed.
223. **Perceptual and Cognitive Processes.** I or II. 3 hr. PR: Psych. 121 or 123, or equiv. Consideration of classical and contemporary research and theory on perception and cognitive processes, including concepts formation and thinking.
224. **Motivation.** I or II. 3 hr. PR: Psych. 121, 122, or equiv. Survey of experimental data and theory in the area of motivation especially as it relates to learning.
227. **Conditioning and Learning.** I or II. 3 hr. PR: Psych. 122 and 121 or 123. Outline of current research in operant and classical conditioning. Controversial issues in learning are reviewed in light of recent research and theory.
231. **Physiological Psychology.** I or II. 3 hr. PR: Psych. 121, 122, and Zool. 271 or equiv. The organic basis for psychological activities such as preception, emotion, motivation, and learning.

232. **Comparative Psychology.** I or II. 3 hr. PR: Zool. 271 and Psych. 121 or 122. Comparison of the structure of representative animals of the various phyla in relation to differences in behavior.
241. **Advanced Developmental Psychology.** II. 3 hr. PR: Psych. 141 and 214 or equiv. Research methods and substantive findings in the psychology of human development from birth to death, emphasizing developmental processes occurring over the entire life-span.
243. **Child Behavior.** I or II. 3 hr. PR: Psych. 1. Growth trends in behavior through adolescence, including development in the physical, intellectual, emotional, social, and personality areas.
247. **Adolescence and Early Adulthood.** I or II. 3 hr. PR: Psych. 241 or equiv., and consent. Psychosexual, psychosocial, and other focal problems of development will be stressed. The role of high school and higher education in growth and development will be examined.
252. **Group Dynamics.** (Same as Sociol. 270). I or II. 3 hr. PR: Psych. 151 or consent. An interdepartmental course, combining psychological and sociological approaches in which the dynamics of groups in operation are considered. The following topics are treated: leadership, informal communication and group processes, the relations of group aims to group organization, and the effects of the group on personality.
253. **Attitudes and Propaganda.** I or II. 3 hr. PR: Psych. 151 or consent. Includes: the nature of attitudes and opinions, attitude measurement, opinion changing, propaganda use and analysis, the social psychology of mass media, democratic values, and public opinion. Designed to meet the needs of students from a variety of fields as well as psychology—especially sociology, political science, and journalism.
262. **Group Psychometric Testing.** I or II. 3 hr. PR: Psych. 1, Stat. 101, or equiv. Theory underlying the construction and use of psychometric measurement techniques for evaluating aptitude, interest, personality, and attitudes.
263. **Introduction to Personality.** I or II. 3 hr. PR: Two upper-division psychology courses, graduate standing or consent. The development and significance of the personality concept in psychology including a survey of the major theories such as Freudian, interpersonal, trait, and learning.
264. **Psychology of Adjustment.** I or II. 3 hr. PR: Two upper-division psychology courses, graduate standing or consent. Dynamic principles of human personality adjustment.
271. **Introduction to Clinical Psychology.** I or II. 3 hr. PR: Two upper-division psychology courses, graduate standing or consent. Review of concepts, techniques, and professional roles in clinical psychology. Foundation for advanced courses in clinical methods and skills. Of interest to advanced undergraduates and graduates in education, guidance, personnel, pre-medicine, and social work as well as professionally-oriented students in psychology.
281. **Abnormal Psychology.** I or II. 3 hr. PR: Two upper-division psychology courses or consent. Survey of the major behavioral disorders; neurosis, psychosis, and character disorder. Emphasis is placed on the developmental dynamics leading to those disorders, and the psychological treatments of them.
282. **Exceptional Children.** I or II. 3 hr. PR: Two upper-division psychology courses, graduate standing or consent. Study of children who present psychological problems because of: (1) exceptional mental retardation or advancement; (2) organic disabilities having behavior consequences, such as cerebral palsy or deafness; (3) disorders of conduct associated with atypical personality functioning. Of special interest to those who regularly deal with children such as teachers, nurses, etc.

304. **Leadership and Human Relations in Working Groups.** I or II. 1-3 hr. PR: Consent. Individual work related to either research or practice in the field of human relations training programs.
307. **Practicum in Industrial Interviewing.** I or II. 3 hr. PR: Psych. 203 or consent. An intensive review of principles of selection and validation as they relate to the interview. Practice interviews applying non-directive techniques in employment and other types of interviews with critiques by instructor.
309. **Seminar: Industrial.** I or II. 2 hr. per sem. PR: Consent. Current research and problems in industrial psychology.
318. **Factor Analysis.** I or II. 3 hr. PR: Psych. 217 or consent. Alternate methods for factor extraction, communalities, rotation in orthogonal and oblique space, and the estimation of factor scores.
319. **Seminar: Methodology.** I or II. 2 hr. per sem. PR: Consent. Current problems in statistics and research methods.
323. **Human Learning.** I or II. 3 hr. PR: Psych. 122, 123 or equiv. Historical and contemporary review of research and theory in verbal learning, transfer, mediation, retention and memory processes, including motor skill learning, verbal conditioning.
325. **Theory Construction.** I or II. 3 hr. PR: Psych. 121 and 122. Consideration of the methods of theory construction and the role of theory in selected areas of psychology.
328. **Seminar: Learning.** I or II. 2 hr. per sem. PR: Consent. Current research and problems in the psychology of learning.
331. **Advanced Physiological Psychology.** I or II. 2 hr. PR: Psych. 231. Neuroanatomical and neurophysiological correlates of complex behavior.
332. **Physiological Psychology Laboratory.** I or II. 2 hr. PR: Psych. 231 and consent. Research techniques used in exploring neural basis of behavior.
337. **Seminar: Physiological.** I or II. 2 hr. per sem. PR: Consent. Current research and problems in physiological psychology.
342. **Infancy and Childhood.** I or II. 3 hr. PR: Psych. 241, or equiv. A theoretical study of psychological growth. Comparative and crosscultural research is emphasized.
343. **Developmental Learning Processes.** I. 3 hr. PR: 12 graduate credit hours in Psychology or related disciplines or consent. A systematic review of research and theory related to the interaction of learning and maturational processes in young children and retardates. Selected topics covered include concept formation, discrimination learning, learning set, conditioning, verbal and language behavior, and other topics of contemporary interest.
344. **Maturity and Old Age.** I or II. 3 hr. PR: Psych. 241 or equiv. and consent. Cognitive and personality changes in middle and old age. Psychological reactions to physiological decrement and dissolution of family units. Emphasis on research and theory explaining aging phenomena.
349. **Seminar: Development.** I or II. 2 hr. per sem. PR: Consent. Current research and problems in developmental psychology.
351. **Advanced Social Psychology.** I or II. 3 hr. PR: Psych. 151 or consent. Consideration of contemporary theory and practice in social psychology. A research project is generally assigned.
359. **Seminar: Social.** I or II. 2 hr. per sem. PR: Consent. Current research and problems in social psychology.
363. **Personality Theory and Research.** I or II. 3 hr. PR: Psych. 263, 214 or equiv. Intensive analysis of current research and theory in the personality area.

369. **Seminar: Personality and Abilities.** I or II. 2 hr. PR: Consent. Consideration of a current problem in the personality and trait measurement areas.

NOTE: All courses in the 370 series are restricted for students in the Clinical Psychology program except by special departmental permission.

371. **Individual Intelligence Testing.** I or II. 3 hr. PR: Psych. 243 and 262, or consent. Theory and practice in Binet, Wechsler, and other individual tests of cognitive functioning.
372. **Objective Personality Assessment Techniques.** I or II. 3 hr. PR: Psych. 214, 371 and consent. Administration, scoring and interpretation of objective personality tests.
373. **Projective Personality Assessment Techniques.** I or II. 3 hr. PR: Psych. 371 and consent. Administration, scoring and interpretation of projective personality tests.
374. **Advanced Personality Assessment.** I or II. 3 hr. PR: Psych. 373 and consent. Supervised practice in the diagnostic application of personality assessment techniques. Includes clerkship in university counseling center and/or other mental health facilities.
375. **Counseling and Psychotherapy.** I or II. 3 hr. PR: Psych. 263, 373, 381 or equiv. and consent. Individual and group psychotherapy.
376. **Practicum in Counseling and Psychotherapy.** I or II. 2-3 hr. PR: Consent or equiv. Supervised experience in psychotherapeutic techniques used by the psychologist in a clinic setting.
377. **Clinical Psychology Practicum.** I or II. 2-6 hr. per sem. PR: Psych. 372, 373, or equiv. and consent. Supervised practice of psychological techniques in clinics or institutional settings. Includes experience in psychological testing, interviewing, report writing, case presentation, interpretation of tests and counseling with parents. Primarily for students in the master's program with clinical emphasis.
378. **Advanced Clinical Practicum.** I or II. 2-6 hr. per sem. PR: Psych. 374, 375, or consent. Supervised practice of psychological techniques in clinics or institutional settings. Psychological evaluation, counseling and psychotherapy, clinical consultation. Emphasis is placed on experiences in multi-disciplinary counseling and mental health settings. Primarily for advanced doctoral students in clinical psychology.
379. **Seminar: Clinical.** I or II. 2 hr. per sem. PR: Consent. Current research and problems in clinical psychology.
381. **Behavior Pathology.** I or II. 3 hr. PR: Psych. 263, 281 or consent. Advanced study of etiology and dynamics of severe behavior pathology.
389. **Seminar: Abnormal.** I or II. 2 hr. per sem. PR: Consent. Current research and problem in abnormal psychology.
390. **Teaching Practicum.** I or II. 1-3 hr. PR: Consent. Supervised practice in college teaching of psychology.
391. **Directed Study.** I or II. 1-3 hr. per sem. PR: Consent. Directed reading and research in special areas.
392. **Master's Thesis.** I, II. 1-6 hr.
397. **Dissertation Research.** I, II. 1-15 hr.
399. **Seminar: Professional Problems.** I or II. 2 hr. per sem. PR: Consent. Current problems involved in the practice of psychology.

RELIGIOUS STUDIES

- 210, 211. **Problems in Contemporary Judaeo-Christian Thinking.** I, II. 3 hr. ea. Issues to be treated include the following: the function of reason in the Christian faith, the Christian understanding of history, the ecumenical and other recent movements within the Church, recent transformations of ethical and social thinking, and new interpretations of traditional Christian doctrines. Secular theology and the new morality are examined. It is highly recommended, but not required, that Religious Studies 100, 101, 102, 103, 120, or 121 be taken as a background for this course. Each semester may be taken independently.
212. **Judaeo-Christian Teachings About the Problems of Man.** I. 3 hr. PR: Either a 100 Religious Studies course or consent. A presentation of the dialog between the existential problems of man, e.g., anxiety, loneliness, meaninglessness, guilt, death, lust, wrath, and others, and the response of the Judaeo-Christian faith. The course embraces an introduction to existential theology.
220. **History of American Religion: 1607-1820.** I. 3 hr. PR: A 100 Religious Studies course or consent. A study of the origins, growth, and influence of the major religious ideas and movements which were significant in the shaping of the religious life of the American people in the colonial and early federal periods.
221. **History of American Religion: 1820 to Date.** II. 3 hr. PR: A 100 Religious Studies course or consent. A study of the origins, growth, and influence of the major religious ideas and movements which have been significant in the shaping of the religious life of the American people since 1820.
223. **Roman Catholic Thought: From the Council of Trent to Vatican Council II.** II. 3 hr. PR: A 100 Religious Studies course or consent. Roman Catholic thinkers and movements in doctrinal, biblical, historical, and social thought; the reform and renewal movement of Vatican Council II; the role of Roman Catholicism in contemporary society.
224. **Christian Thought in the Reformation Era.** 3 hr. PR: A 100 Religious Studies course or consent. A study of the significant men and movements in the four primary streams of sixteenth century Christian thought in western Europe: Protestantism, radical Christianity, Roman Catholicism, and Anglicanism.
226. **Early Medieval Theology and Culture.** I. 3 hr. PR: A 100 Religious Studies course or consent. A study of the primary ways in which early medieval Christian thought responded to the cultural heritage of the West. Major consideration will be given to the rise of the medieval synthesis of theology and culture.
227. **Late Medieval Theology and Culture.** II. 3 hr. PR: A 100 Religious Studies course or consent. A study of the medieval theological, philosophical, cultural synthesis in the period A.D. 1200-1450. Emphasis will fall upon such topics as the rise of the universities, papal absolutism, mendicant orders, and conciliarism.
230. **World Religions: Religions of India.** I. 3 hr. Proto-Indian religion, Hinduism, the beginnings of Buddhism, Jainism, Sikhism; historical and theological foundations; developments of thought; contemporary expressions and encounter with the modern world.
231. **World Religions: Religions of China and Japan.** II. 3 hr. Buddhism, Confucianism, Taoism, Shinto: historical and theological foundations; developments of thought; contemporary expressions and encounters with the modern world.
232. **World Religions: Zoroastrianism, Islam, and Modern Syncretisms.** I. 3 hr. An investigation of the historical and theological foundations and the subsequent development of Zoroastrianism, Islam, and modern attempts at syncretism such as Soka Gakkai and Bahai.

233. **Comparative Religions. II.** 3 hr. PR: A 100 Religious Studies course or consent. A comparison of the answers given by the major contemporary religions to questions concerning the nature of the Absolute, man, sin, salvation, and the good life.
- 240, 241. **Theology of Culture. I, II.** 3 hr. PR: A 100 Religious Studies course or consent. An interdisciplinary course involving members of various parts of the faculty of the University in dialog with a professor of religious studies. An encounter between theology and the various secular fields of study. Each semester may be taken independently.
290. **Seminar: Selected Topic. I or II.** 3 hr. PR: A 100 Religious Studies course or consent. Seminar. Selected Topic. I or II.
291. **Seminar: Selected Topic. I or II.** 3 hr. PR: A 100 Religious Studies course or consent. Seminar. Selected Topic. I or II.

SOCIOLOGY

Candidates for the Master's Degree in Sociology must have an adequate undergraduate preparation in sociology or make up the deficit by taking courses which will not be credited toward the graduate degree. This latter may mean an additional semester or summer term of study. If not taken for undergraduate credit, Sociology 202 and 246 (or equivalents), and a course in statistics will as a rule be included in the master's program. Master's candidates are expected to earn 12 hours of seminar credit. A thesis is required of all candidates. Except where the student has a strong preparation in sociology, the thesis requirement is in addition to 30 hours of course work. The candidate must pass a final examination, which may be oral, written, or both, at the discretion of the Department. A part of this examination will test the candidate's general comprehension of the field of Sociology.

Sociology 1 or equivalent, or Social Science 1, 2, is prerequisite for all courses in the 200 series.

Sociology

202. **Introduction to Social Research. I.** 3 hr. Trends in social research; examination and methods and techniques.
205. **Urban Sociology. II.** 3 hr. Sociological analysis of institutional structure, social values, and individual goals in urban-industrial society; bureaucratization, collectivization, and mass culture; emphasis on political, economic, religious, and family institutions.
206. **Sociology of Rural Life. II.** 3 hr. Social aspects of rural living. Characteristics of rural population, social structure, and institutional arrangements: family, community, education, religion, recreation, health, welfare, and local government.
207. **Community Development. I.** 3 hr. An applied course in which principles and techniques of community organization and development are organized.
208. **The Community. II.** 3 hr. An analytical course intended chiefly to provide background data for students interested in programs of community action. Topics to be included are: the basic characteristics of communities; community institutions and resources; social cleavage within the community; and community survey and community planning.
210. **The Family. I, II.** 3 hr. Sociological analysis of the contemporary family and its problems.
211. **Sociology of Childhood. II.** 3 hr. Adjustment of child to American culture.
216. **Sociology of Education. I, II.** 3 hr. An examination of education as a social institution; cultural and class influences on education; social roles and career patterns in the school system; the school and problems of the community.

218. **The Sociology of Economic Life.** I. 3 hr. Economic behavior is examined in the context of the social environment. The interaction of selected social-psychological variables with economic motivation and behavior is examined. Attention is given to occupational selection, work careers, the changing meaning of work, effects of unemployment and downward mobility upon the individual, and criteria of employability.
220. **Social Change.** I. 3 hr. Sociological analysis of the major changes now going on in our society, of the forces underlying them, and of the tensions to which they give rise. Alternative future directions; rational manipulation and planning for social change.
224. **Social Stratification.** I. 3 hr. Description and analysis of various types of stratification systems, such as class and caste; social mobility, and status-striving. The course emphasizes the place of status, prestige, and power in the structure of American society.
229. **Population and Migrations.** I. 3 hr. Population theories; growth, composition, and distribution of American population; immigration and culture pluralism; internal migrations and their consequences.
231. **Race Relations.** I. 3 hr. Race relations in the U.S. with emphasis on the American Negro.
233. **Criminology.** II. 3 hr. Explanation of crime; critical study of criminal justice, penal methods, and reform movements.
234. **Juvenile Delinquency.** I. 3 hr. A scientific study of the nature, extent, and causes of delinquency in the United States. Methods of treatment, correction, and prevention, with emphasis on the work of the juvenile courts.
235. **Collective Behavior.** II. 3 hr. Analysis of new group formation and behavior following social dislocation, social unrest, crowd behavior, and other forms of social contagion; the public and public opinion; social movements.
244. **Culture and Personality.** I. 3 hr. Significant interrelations between the individual and his culture.
246. **Types of Sociological Theory.** II. 3 hr. Examination of leading schools of sociological thought in our day.
250. **Human Relations in Industry.** II. 3 hr. The sociology of industrial relations. The factory of business firm as a social system. Formal and informal relations within the plant.
260. **Complex Organizations.** I. 3 hr. A sociological analysis of large-scale organizations, emphasizing their structure and functions. The course will examine the place in contemporary society of such organizations as the military, prisons, and hospitals.
265. **The Sociology of Latin America.** II. 3 hr. A systematic sociological consideration of the problems of the "underdeveloped" countries with special emphasis on Latin America: its culture, social structure, and national character. The main emphasis will be on social change.
270. **Group Dynamics** (Same as Psych. 270.) I. 3 hr. An interdepartmental course, combining psychological and sociological approaches, in which the dynamics of groups in operation are considered.
275. **Cultural Dynamics.** I. 3 hr. The nature of culture and culture change. Historical trends in the study of cultural dynamics: focal interests, doctrines, and methods of study.
278. **Comparative Religious Systems.** II. 3 hr. An overview of the nature and variety of human religious systems with emphasis on examples from non-Western cultures. The functions, development, and change in systems of religious belief and practice, illustrated with ethnographic materials.

281. **African Society and Culture.** II. 3 hr. Analysis of contemporary societies and cultures south of the Sahara, with some emphasis on current changes.
 282. **Latin-American Society and Culture.** II. 3 hr. A survey of the post-conquest societies and cultures, with emphasis on present-day types of sociocultural arrangements.
 285. **Introduction to Archaeology.** I. 3 hr. Survey of archaeology: its methods and significance for the understanding of prehistoric cultures.
 286. **Archaeology of Appalachia.** II. 3 hr. Intensive study of the content distribution, sequence, and significance of early Appalachian Indian cultures.
 290. **Special Topics in Anthropology.** I, II. 3 hr. Tutorial or seminar for selected strongly qualified students.
- Prerequisite for all courses in the "300" series: Consent of department chairman.
321. **Seminar.** 3-9 hr.
 322. **Seminar.** 3-9 hr.
 324. **Tutorial.** 3-9 hr.
 - 371, 372. **Thesis.** I, II. 1-6 hr.

SPEECH

The Degree of Master of Arts

The Department of Speech offers work leading to the Master of Arts degree in General Speech, Rhetoric and Public Address, and Radio, Television, Film. Persons who possess a bachelor's degree from an accredited college or university may be admitted to the program. Although normally the entering graduate student has an undergraduate major in speech, qualified students from related areas are admitted with the understanding that any deficiencies in undergraduate preparation in speech must be made up without credit toward the Master of Arts degree, or added to the credit requirements for the degree.

In addition to the general requirements of the Graduate School, the graduate student in speech must meet the following departmental requirements:

- I. Successful completion of the minimum number of required graduate hours as set forth in Program A or Program B below.
- II. Completion of Speech 301 and at least one Seminar in speech.
- III. Successful passage of three 3-hour written comprehensive examinations.
 - A. A "B" average is pre-requisite to the writing of such examination.
 - B. No student shall be considered a candidate for the Master of Arts degree in speech, nor permitted to take the final oral examination, until he has passed his comprehensive examinations.

Program A — The Thesis Program

1. Successful completion of at least 30 hours of graduate credit, 21 of which must be in the curriculum of the Department of Speech.
 - a. A maximum of six hours of research and thesis may be included in the twenty-one hours.
 - b. Problem topics in Speech 375 (Independent Study), and Speech 397 (Research), may not be expanded into a thesis.
2. Pursuit of courses in cognate fields upon the advice and approval of the Department Graduate Committee.
3. A thesis demonstrating original research and scholarly reporting.
4. Satisfactory completion of an oral examination on the thesis.

Program B – The Non-Thesis Program

1. Satisfactory completion of a minimum of 36 semester hours of graduate credit, 24 of which must be in the curriculum of the Department of Speech.
2. Satisfactory completion of an oral examination relating to speech theory, principles, methodology, and philosophy to ascertain the candidate's general knowledge in the field of speech.

Speech

220. **Speech Composition. II.** 3 hr. PR: Consent. An upper-division course which stresses the theories of organization, support, and style. Study of model speeches and the writing of speeches; application to delivery.
221. **Persuasion. I.** 3 hr. PR: Speech 11 and consent. Study and practice in identification of factors motivating human behavior and belief, how to secure and hold attention, the uses of suggestion, the dramatization of ideas. Application to advertising and writing as well as speaking.
222. **Forms of Public Address. II.** 3 hr. PR: Consent. Study of the principles of composition and delivery of the oration, political speech, the speech of introduction, dedicatory address, eulogistic speech, and similar occasional speeches. Models of these and other forms of public address are analyzed and evaluated.
225. **Interscholastic Forensics. S.** 3 hr. PR: Consent. Prepares the speech teacher to train students for interscholastic speaking activities such as debate, oratory, extemporaneous speaking, and radio announcing. Study of the principles and techniques of administering a forensic program and conducting extracurricular activities in speech.
270. **Psychology of Speech. II.** 3 hr. PR: Consent. Modern psychological principles of speech learning and usage. Influences of emotion, conditioning, and habit on listening, thinking, language, learning, judgments, imagery, and personality as factors in oral communication.
275. **Speech Problems of Children. S.** 3 hr. PR: Consent. Normal maturational development of listening and speaking skills, their relationships to language acquisition, and their influences upon achievement in reading and writing. Primarily for elementary school teachers and principals, language arts supervisors, speech therapists, and students in guidance and counseling.
280. **Radio and Television Dramatic Writing. II.** 3 hr. PR: Speech 80 and Speech 184 or consent. Theory and practice of the basic principles of broadcast dramatic script writing. Documentaries, poetry programs, serial dramas, and children's shows for commercial and educational purposes. Scripts are written to be aimed at definite markets.
282. **Radio Workshop. I.** 3 hr. PR: Speech 181 or Speech 182, or consent. Discussion of techniques of radio production. Laboratory experience in the production of University radio programs. Adapted to students interested in commercial and educational broadcasting.
283. **Television Workshop. I.** 3 hr. PR: Speech 185 or consent. Discussion of techniques of television production. Laboratory experience in the production of University television programs. Adapted to students interested in commercial and educational broadcasting.
284. **Radio and Television Program Planning. II.** 3 hr. PR: Speech 80 and consent. Analysis of the purpose and basic idea of a program in relation to audience composition. Requirements of effective structure. Practice in laying out program formats for all types of radio and television programming.
289. **Documentary Film Production. II.** 3 hr. PR: Speech 189 and 184 or consent. A detailed study of the documentary as a film form and social commentary. Class will be divided into multiple film units which will complete the production of a documentary film, using professional 16 mm equipment. Lab fee.

301. **Research Problems and Methods. I.** 3 hr. PR: Graduate standing. Required of all candidates for Master's Degree in Speech.
330. **History of Rhetoric. I.** 3 hr. PR: Consent. Critical study of rhetoric from classical times to the present. Special attention given to Aristotle, Cicero, and Quintilian.
333. **Special Topics. I, II, S.** 3-12 hr. PR: Consent. A thorough study of some special topic in Speech, including British Public Address, Rhetorical Criticism, Communication Theories, and Semantics. Limited to 3 hr. per sem.
335. **American Public Address to 1860. I.** 3 hr. PR: Consent. Critical study of leading American speakers of the Colonial period through the Early National period, their biographies, speeches, and issues with which they dealt.
336. **American Public Address Since 1860. II.** 3 hr. PR: Consent. A critical study of leading American speakers, their speeches, and the issues with which they dealt, from the Later National Period to 1960.
339. **Seminar: Problems in Speech. I, II.** 3 hr. PR: Consent. Current research and problems in General Speech and Rhetoric and Public Address.
375. **Independent Study. I, II, S.** 1-3 hr. PR: Speech 301, a speech seminar, and consent of chairman of department. Open to graduate students in speech who are pursuing independent problems in that field.
388. **Film Directing and Cinematography. S or I.** 3 hr. PR: Speech 289. An advanced study of motion picture production from the directional and cinematographic standpoint. Students will undertake individual film projects which will explore the possibilities of the film medium as an expressive art form. The class will produce a short 35-mm film. Lab fee.
389. **Seminar: Problems in Radio, Television, and Motion Pictures. I or II.** 3 hr. PR: Consent. Discussion and research into various issues and problems in the broadcast media.
397. **Research. I, II, S.** 1-3 hr. PR: Speech 301, a speech seminar, and consent of chairman of department. For graduate students in speech.
399. **Thesis. I, II, S.** 2-4 hr.

Commerce

The College of Commerce offers graduate programs in business administration and economics. The program in business leads to the degree of Master of Business Administration (M.B.A.). These programs are supervised by the Graduate Faculty in Business Administration and students in them are administered by the Director of Graduate Programs in Business.

Graduate programs in economics lead to the degrees of Master of Arts (M.A.) and Doctor of Philosophy (Ph.D.). These programs are supervised by the Graduate Faculty in Economics and students in them are administered by the Director of Graduate Programs in Economics.

All graduate programs in the College of Commerce require that the student maintain a grade-point average of at least 3.0 (B) on all work taken as a graduate student while enrolled in the College, including prescribed work taken to remove undergraduate deficiencies. A student whose cumulative grade-point average falls below 2.5 will be placed on probation. If his average is not brought up to 2.5 by the end of the following semester, he will be suspended. A grade below "C" in any course taken while enrolled as a graduate student will result in suspension from the graduate programs of the College of Commerce. In addition, the student must maintain a 3.0 (B) average in all work counting toward the graduate degree.

All work for a graduate degree must be completed within a period of seven years. An extension of this period must be approved in writing by the appropriate graduate faculty and the dean of the Graduate School.

Graduate Program in Business Administration

To receive approval to enter the M.B.A. program an applicant must have a baccalaureate degree from an accredited college or university, with an undergraduate average of at least 2.5 (of a possible 4.0) or a baccalaureate degree and an acceptable score on the Admission Test for Graduate Study in Business. (Persons in the latter category are approved to enter the program on a probationary basis.) To assure that all students in the program have the same foundation in business, the applicant must have completed the following courses:

- Principles of Accounting (2 semesters)
- Principles of Economics (2 semesters)
- Principles of Marketing
- Principles of Management (or Industrial Management)
- Business Finance
- Principles of Statistics

A student without the necessary prerequisite courses may be approved to enter the M.B.A. program on probation subject to removal of any deficiencies prior to his taking the required graduate courses. All applicants for the M.B.A. program must submit scores in the general aptitude test of the Graduate Record Examination and the Admission Test for Graduate Study in Business. While scores on the Admission Test for Graduate Study in Business must be submitted before an applicant can be considered for the M.B.A. program, students may be admitted provisionally without the Graduate Record Examination providing that they take it on the first date it is offered after admission. All applications for approval to enter the M.B.A. program must be received in the Admissions Office of the University at least one month prior to the date for which enrollment is requested.

Master of Business Administration (M.B.A.)

The candidate's program of courses will be planned with the assistance of a faculty adviser and must have his approval. The M.B.A. degree requires a total of 36 hours of graduate credit, including the following courses:

*Fall Semester**

Accounting	301—Managerial Control, 3 hr.
Economics	301—Managerial Economics, 3 hr.
Economics	302—Research and Reports, 1 hr.
Management	301—Administrative Practices, 3 hr.
Management	302—Quantitative Business Analysis, 3 hr.

*PR: The undergraduate courses listed above, or consent.

*Spring Semester***

Economics	302—Research and Reports, 2 hr.
Finance	313—Financial Administration, 3 hr.
Management	313—Production Administration, 3 hr.
Marketing	313—Marketing Administration, 3 hr.

Summer Session

Management	323—Administrative Policy, 3 hr.***
------------	-------------------------------------

**PR: The required courses offered in the fall semester, or consent.

***PR: The required courses offered in both the fall and spring semester, or consent.

The candidate will also complete 9 semester hours of elective courses selected with the approval of his adviser. Of these electives, at least 3 hours must be in a graduate course of the College of Commerce at the 300 level, preferably in a graduate seminar in business. No thesis is required, but writing is emphasized in all courses. The candidate must pass a comprehensive examination covering the material in the required courses. This examination is normally taken during the semester in which the required courses, with the exception of Management 323, will be completed and may be repeated only once.

GRADUATE PROGRAM IN ECONOMICS

All applicants must take both the general aptitude test and the economics advanced test of the Graduate Record Examination. Prior to admission to the program, students are required to have completed at least 18 semester hours of course work in economics. Six of these hours may be in principles of economics, at least 3 hours must be in statistics, and not more than 3 hours may be from the functional fields of accounting, finance, marketing, management, etc. A minimum grade of "C" is required in each of the courses taken to meet the 18 hour economics requirement. Applicants must have a 2.5 grade-point average or better ($A = 4.0$) for all undergraduate work completed.

Students who do not meet these entrance requirements may be admitted on probation subject to the correction of the deficiencies at the beginning of the program. Deficiencies in undergraduate preparation must be removed without graduate credit. No student will be admitted on probation unless his grade-point average is at least 2.0.

To qualify for either the M.A. or Ph.D. degree, graduate students in economics must earn a cumulative grade-point average of 3.0 (B) in all courses attempted during their tenure as graduate students at West Virginia University.

Master of Arts (M.A.)

The candidate's program of courses will be planned with the assistance of the faculty adviser and must have his approval. The M.A. degree requires a total of 30 semester hours of graduate credit, including 18 hours in the graduate core curriculum in economics and an acceptable thesis (6 hours). The students must make a passing grade on a qualifying examination in statistics, or alternately, a minimum grade of "B" in Advanced Statistics (Economics 226 or equivalent courses).

The following courses constitute the graduate core curriculum in economics:

Economics

310—Advanced Micro Theory I, 3 hr.

311—Advanced Micro Theory II, 3 hr.

312—Advanced Macro Theory I, 3 hr.

313—Advanced Macro Theory II, 3 hr.

316—History of Economic Doctrines and Analysis, 3 hr.

320—Quantitative Analysis, 3 hr.

Doctor of Philosophy (Ph.D.)

At least three years of full-time graduate work beyond the baccalaureate degree are usually required to qualify for the doctorate. Two of the three years of residence must be at West Virginia University, including at least two consecutive semesters in actual residence as a full-time graduate student.

The Ph.D. degree is not awarded for the mere accumulation of course credits nor for the completion of the specified residence requirements. A minimum, however, of 36 hours of graduate work in economics at the 300-level is required for all candidates for the Ph.D. degree in economics. These must include 18 hours in the graduate core curriculum in economics which includes:

Economics

310—Advanced Micro Theory I, 3 hr.

311—Advanced Micro Theory II, 3 hr.

312—Advanced Macro Theory I, 3 hr.

313—Advanced Macro Theory II, 3 hr.

316—History of Economic Doctrines and Analysis, 3 hr.

320—Quantitative Analysis, 3 hr.

Three additional hours must consist of a seminar in the candidate's field of concentration. The remaining 15 hours will be selected by the student with approval of his adviser.

For admission to candidacy for the Ph.D. Degree the student must:

1. Demonstrate the ability to read one foreign language in a satisfactory manner. This may be any language in which there exists a significant literature in the student's major field of study, and which is acceptable to the student's major department and to the Dean of the Graduate School. For any language other than French, German, or Russian, approval of the Dean must be requested by the student's adviser.

2. Demonstrate proficiency in statistical technique by successful completion of a qualifying examination or, alternatively, by achieving a minimum grade of "B" in Advanced Statistics (Economics 226 or equivalent courses.)

3. Successfully complete preliminary examinations in four fields which include economic theory (Micro Theory, Macro Theory, and History of Economic Doctrines), two other fields of concentration in economics and one other field in economics or in an outside area. The selection of an outside field must be done with the advice and consent of the student's graduate committee.

When an applicant has successfully passed his qualifying examinations, he will be formally promoted to candidacy for the doctoral degree. Admission to candidacy must precede the final examination for the doctoral degree by at least one academic year.

The candidate must submit a thesis pursued under the direction of the Graduate Faculty in Economics on some problem in the area of the candidate's major interest. The thesis must present the results of the candidate's individual investigation and must embody a definite contribution to knowledge. It must be approved by a committee of the Graduate Faculty in Economics. An oral examination on the thesis is required.

After approval of the candidate's thesis and satisfactory completion of other graduate requirements, he shall have a final examination by his advisory committee. See the general regulations for graduate degree beginning on page 25 for further information on the dissertation, residence requirements, final examination, request for degree, and attendance at commencement.

Accounting

- 211. **Accounting Systems. I.** 3 hr. PR: Accounting 112. The adaption of accounting procedures to the demands of the firm, with emphasis on theoretical factors important to efficiency and internal control; system surveys and reports, the design of forms, office machine applications.
- 213. **Income Tax Accounting. I.** 3 hr. PR: Accounting 112 or consent. Tax theory and practice as developed from the regulations of the Internal Revenue Service; problems in preparation of tax returns for individuals, partnerships, and corporations.
- 214. **Income Tax Accounting. II.** 3 hr. PR: Accounting 213. A continuation of Accounting 213.
- 216. **Advanced Cost Accounting. II.** 3 hr. PR: Accounting 115. Advanced work in the application of cost theory and procedures to cases and problems which emphasize the managerial use of cost information.
- 217. **Auditing Theory. I or II.** 3 hr. PR: Accounting 112. Auditing fundamentals; objective standards and procedures; introduction to working-paper techniques; procedure statements of the American Institute of C.P.A.'s.
- 218. **Auditing Practice. I or II.** 3 hr. PR: Accounting 217. Application of auditing theory and procedures, with emphasis on decisions which invoke judgment and are important in independent audits; audit working papers and reports; case studies.
- 224. **Advanced Accounting Problems. I or II.** 3 hr. PR: Minimum of 18 hours in accounting with an average grade of "B" or higher. Analysis and solution of representative C.P.A. problems.
- 230. **Advanced Accounting Theory. I or II.** 3 hr. PR: Accounting 112, 115, and consent. Critical analysis of accounting concepts and standards with emphasis on their origin, development, and significance.
- 301. **Managerial Control. I.** 3 hr. PR: Accounting 52 and Econ. 125. The use and significance of the quantitative techniques of accounting, statistics, and budgeting for planning, control, and decision making.
- 329. **Seminar in Accounting. I or II.** 3 hr.
- 395. **Thesis in Accounting. I, II.** 1-6 hr.

Economics

Specialized Courses

- 205. **Current Economic Problems. S.** 3 hr. PR: Econ. 51 and 52 or consent. For students in Education only. A course designed to acquaint public school teachers with reliable source material in economics and to instruct them in studying current economic problems.
- 265. **Economics of Social Security. I or II.** 3 hr. PR: Econ. 51 and 52 or consent. An examination and analysis of our social and political efforts to provide economic security, including an examination of the parallel developments of private insurance.
- 301. **Managerial Economics. II.** 3 hr. For students in the M.B.A. Program. An analysis of markets and the problems of management in appraising business conditions and in adjusting to changes in product demand, costs, level of output, and profits.
- 302. **Research and Reports. I, II.** 1-3 hr. For students in the M.B.A. Program. A study of sources of business information and research procedures, with application in the preparation of reports.

Economic Theory

- 210. **Comparative Economic Systems.** I or II. 3 hr. Structure and processes of existing economic systems throughout the world including review of basic principles of free enterprise, socialistic, communistic, and fascistic societies. Comprehensive analysis based on current and recent experiments in these economies.
- 211. **Micro Economic Analysis.** I. 3 hr. A study of price and output determination and resource allocation in the firm under various competitive conditions.
- 212. **Macro Economic Analysis.** II. 3 hr. An analysis of the forces which determine the level of income, employment, and output. Particular attention is given to consumer behavior, investment determination, and government fiscal policy.
- 213. **Economic Development.** I or II. 3 hr. A comprehensive study of the problems, changes, and principal policy issues faced by non-industrialized countries in the process of economic development.
- 216. **History of Economic Thought.** II. 3 hr. Economic ideas in perspective of historic development.
- 310. **Advanced Micro Theory I.** I. 3 hr. Theory of production and allocation, utility theory, theory of the firm, pricing in perfect and imperfect markets, models of firm's operations.
- 311. **Advanced Micro Theory II.** II. 3 hr. PR: Econ. 310. General equilibrium analysis, distribution theory, welfare economics.
- 312. **Advanced Macro Theory I.** I. 3 hr. Classical, Keynesian, and Post-Keynesian theories.
- 313. **Advanced Macro Theory II.** II. 3 hr. PR: Econ. 312. Model of economic growth and fluctuations.
- 316. **History of Economic Doctrines and Analysis.** I. 3 hr. Study of the writings of the major figures in the development of economic doctrines and analysis.
- 319. **Seminar in Economics.** II. 3 hr.

Quantitative Economics

- 220. **Introduction to Quantitative Analysis.** I. 3 hr. PR: Econ. 125. Study of the principal mathematical techniques employed in economic analysis; an introduction to econometrics.
- 226. **Advanced Statistics.** II. 3 hr. PR: Econ. 125 or equivalent. An advanced approach to statistical analysis with emphasis on probability, inference, and multivariate statistical techniques.
- 320. **Quantitative Analysis.** II. 3 hr. PR: Econ. 220 or consent. Linear programming, input-output analysis, game theory, decision theory, and dynamic models.
- 325. **Econometrics.** I or II. 3 hr. Specification, statistical estimation, and verification of economic models. Problems of applications of econometric analysis.
- 329. **Seminar in Economic Analysis.** I or II. 3 hr.

Monetary Economics

- 330. **Monetary Economics.** I or II. 3 hr. Sources and determinants of the supply of money; the demand for money for transactions and speculative purposes; general equilibrium theory of money, interest, prices, and output; the role of money in policy.
- 334. **Seminar in Monetary Economics.** I or II. 3 hr.

Public Finance

- 241. **Public Finance.** I or II. 3 hr. Governmental fiscal organizations and policy; taxes and tax systems with particular emphasis upon the Federal Government and the State of West Virginia.
- 340. **Theory of Public Finance.** I or II. 3 hr. Systematic study of the economic role of government in a mixed economy with regard to resource allocation between the public and private sectors, the influence of government upon income distribution and upon economic stability and growth.
- 344. **Seminar in Public Finance.** I or II. 3 hr.

Public Regulation and Control

- 245. **Government and Business.** I or II. 3 hr. Government in its role of adviser and umpire; analysis of governmental policies and practices affecting business.
- 246. **Transportation.** I or II. 3 hr. Development of an inland transportation system and relations and policies of transport agencies.
- 345. **Public Regulation and Control.** I or II. 3 hr. Economic analysis of the public control of enterprises under the jurisdiction of federal and state regulatory authorities.
- 349. **Seminar in Public Regulation and Control.** I or II. 3 hr.

International Economics

- 250. **International Economics.** I or II. 3 hr. Development of trade among nations; theories of trade, policies, physical factors, trends, and barriers in international economics.
- 350. **Advanced International Economics.** I or II. 3 hr. Contemporary theories of international economics; analysis of current problems in world trade and finance.
- 354. **Seminar in International Economics.** I or II. 3 hr.

Regional Economics

- 255. **Regional Economics.** I or II. 3 hr. Analysis of factors that promote or deter the economic growth of a region, with emphasis on such matters as population shifts, economic base studies, industrial location analyses, input-output techniques, regional income estimation, local multiplier and cycle concept, and the role of government in regional growth.
- 355. **Advanced Regional Economics.** I or II. 3 hr. Regional income and flow of funds estimation, regional cyclical behavior and multiplier analysis, industrial location and analysis, techniques of regional input-output measurement, the impact of local government reorganization on the level of regional public service and economic development.
- 359. **Seminar in Regional Economics.** I or II. 3 hr.

Labor Economics

- 261. **Trade Unionism.** I or II. 3 hr. PR: Econ. 160 or consent. Analysis of the structure, government, attitudes, and policies of organized labor; the implications of union policy.
- 262. **Collective Bargaining.** I or II. 3 hr. PR: Econ. 160 or consent. Theory and practice of collective bargaining; including contract issues, types of relationships, and the role of government policy.

- 263. **Economics of Wages.** I or II. 3 hr. PR: Econ. 160 or consent. Determination of wage levels and structure; the functioning and organization of labor markets.
- 360. **Advanced Labor Economics.** I or II. 3 hr. Economic effects of trade unionism; measurement and impact of unemployment; the functioning of labor markets; the operation of labor unions; selected aspects of collective bargaining; issues in social legislation.
- 364. **Seminar in Labor Economics.** I or II. 3 hr.

Economic History

- 270. **Strategic Factors in American Economic Growth.** I or II. 3 hr. Regional impact of changing methods of production and distribution.
- 370. **Economic History: Regional Economic Development of the United States.** I or II. 3 hr. The regional development of the Pacific Coast, Southwest, Lower South, the Old Northwest and New England.
- 314. **Seminar in Economic History: The Emergence of Modern Europe.** I or II. 3 hr.

Other Economics Courses

- 390. **Independent Reading in Economics.** I or II. 3-6 hr. Supervised readings in special areas.
- 395. **Thesis in Economics.** I, II. 1-6 hr.

Finance

- 216. **Risk Management.** II. 3 hr. PR: Finance 115 or consent. A study of the transferable risks with which the entrepreneur must deal. Emphasis is on the process by which decisions are made for the handling of these risks, including an examination of the contributions and limitations of the insurance system.
- 313. **Financial Administration.** II. 3 hr. PR: Finance 111. A study of problems in business finance including those related to the financial structures of corporations and the working-capital and fixed-capital needs of a firm.
- 329. **Seminar in Finance.** I or II. 3 hr.
- 395. **Thesis in Finance.** I, II. 1-6 hr.

Management

- 213. **Problems in Business Administration.** I or II. 1-3 hr.
- 216. **Personnel Management.** I, II. 3 hr. Principles and practices in the direction, coordination, and remuneration of manpower.
- 225. **Business Policy.** I, II. 3 hr. PR: Senior standing and consent. Integrated study of policies, organization, facilities, and control techniques of business enterprises.
- 301. **Administrative Practices.** 3 hr. PR: Management 111 or consent. A study of interpersonal relationships through which administration becomes effective. Emphasis is on the human factors, but the influences of economic and technological factors are also considered. Focus is on the importance of harmony between individual needs and organizational goals.
- 302. **Quantitative Business Analysis.** I. 3 hr. PR: Econ. 125 or equiv. A review of probability and Bayesian Statistics, multiple correlation, linear programming, and planning and control techniques with an introduction to data processing through computer solution to problems in these areas.

- 313. **Production Administration.** I. 3 hr. PR: Management 111. The review and application of analytical techniques to complex manufacturing problems.
- 323. **Administrative Policy.** II. 3 hr. PR: Consent. An integrated study of policies, organization, facilities, and control techniques of business enterprises.
- 329. **Seminar in Management.** I or II. 3 hr.
- 395. **Thesis in Management.** I, II. 1-6 hr.

Marketing

- 210. **Industrial Purchasing.** I. 3 hr. PR: Marketing 111. A survey of corporate procurement problems facing modern purchasing executives.
- 215. **Marketing Research.** II. 3 hr. PR: Marketing 111. The utilization of marketing research techniques in the solution of practical marketing problems.
- 313. **Marketing Administration.** I. 3 hr. PR: Marketing 111. The analysis of problems met by management in distributing goods and services efficiently to consumers.
- 329. **Seminar in Marketing.** I or II. 3 hr.
- 395. **Thesis in Marketing.** I, II. 1-6 hr.

Creative Arts Center

The Creative Arts Center incorporates within a single administrative unit the Divisions of Music, Art, and Drama. The administrative entity was established in 1964. The \$7 million first phase of the Creative Arts Center building was completed in the fall of 1968. This new building, when all phases are constructed, will fulfill the academic needs of the disciplines and also provide full facilities through its theatres and galleries for public performances and exhibits. Each of the divisions offers various graduate degree programs in its appropriate areas.

DIVISION OF MUSIC

Prospective graduate students in music are required to have completed the appropriate curriculum of undergraduate study in music at West Virginia University, or its equivalent at another institution of recognized standing. For acceptance as a degree student the applicant must:

1. For the Master of Music degree, have an average of 2.5 on all undergraduate study; for the Ph.D. and Doctor of Musical Arts, have an average of 3.0 on the Master's degree or equivalent.

2. Submit to the Division of Music a score of at least 35 on the Miller Analogies Test.

3. Demonstrate by audition or a tape recording a level of attainment on the major instrument no more than one grade-level below the stated entrance level as indicated for the respective curriculum.*

Students will not be accepted as degree candidates who are deficient in more than one of the three above requirements. Applicants accepted for degree study must take Entrance Tests in Theory and Music History, and audition on piano. These tests and auditions will be given two days prior to registration. The results of these might indicate the need for remedial study.** Applicants for the areas of Theory and Com-

position will be tested more specifically in counterpoint (both 16th and 18th century), form, instrumentation, and orchestration. Applicants seeking acceptance as composition majors must also submit representative compositions for evaluation and approval.

Applicants who have been admitted to the Graduate School, but whose averages and test scores do not meet the qualifications outlined above, will be accepted as Special Graduates. If upon completion of at least 15 semester hours of graduate study they have maintained a "B" (3.0) average, and when any previous undergraduate deficiencies are removed, such Special Graduates will be accepted as degree students.

The Miller Analogies Test may be taken at any time by appointment at numerous college testing centers around the country. (The Division of Music can supply addresses upon request.) If a tape recording is submitted, it must be of a high quality, 7½ ips, and clearly marked as to name, titles of compositions, and types of tracks used (i.e., half track, quarter track mono, quarter track stereo, etc.). The best recordings still leave much to be desired and a personal audition is encouraged if at all feasible. The auditions are administered, on Saturdays, on announced dates six times throughout the school year and summer. These dates are available upon request. For each semester or the summer session the last date is approximately six weeks prior to registration.

THE DEGREE OF MASTER OF MUSIC

Candidates must establish an overall grade-point average of 3.0 (B) within a maximum of 36 hours. Applicants will be admitted to candidacy upon the completion of 12 semester hours of graduate study. No student will be admitted to candidacy until he has removed all undergraduate deficiencies and maintained a 3.0 (B) average in all graduate work completed.

Candidates for the Master of Music degree may major in one of five fields: Music Education, Applied Music, Theory, Composition, History of Music.

Graduate students majoring in Music Education will be allowed one of four options, to be determined in consultation with their adviser: (1) Thesis option; (2) Recital option (if the candidate demonstrates at least grade level of 8½ ability on his major instrument when entering); (3) Thirty-six hour option; and (4) Certification option (intended for persons possessing a bachelor's degree with a major in music). For the first three options there are the following requirements:

1. Thirty graduate hours for thesis and recital options, thirty-six graduate hours otherwise, with an average of 3.0 (B).

2. Required courses: Music 310, Music 344, Music 346, one course each in the areas of theory and music history, and either Music 340 or Music 342.

3. Achievement of grade level 8 on the major instrument.

4. Passing of an oral examination in areas of music education, music history, and music theory.

5. Successful completion of a 4-hour thesis or 2-hour recital for the thesis and recital options respectively.

For the certification option, a special selection of approximately 21 hours is made in cooperation with the Division of Education to satisfy certification requirements. The other hours, to make a total of 36, are electives selected to provide a good background for teaching. Undergraduate courses may be required to make up deficiencies in areas of performance or conducting.

A representative public recital is required of candidates majoring in Applied Music. Composition majors must submit as a thesis a composition in a large form.

*See "Graduate Applied Music Requirements," a listing available at the Division of Music office.

**Recent graduates of the Division of Music will be admitted on their past record without these entrance examinations, unless it is deemed necessary by the Dean of the Creative Arts Center.

All candidates for the Master of Music degree are required to participate at least two clock hours per week for two semesters (or summer terms) in a performing group selected with the approval of the adviser.

A general comprehensive oral examination must be passed by all candidates for the Master of Music degree. Candidates may repeat this examination after a three-month period. The results of the second oral examination will normally be considered final. The examining committee will decide immediately after an unsuccessful second attempt whether a petition for a third attempt will be granted.

The following are the five curricula:

<i>History of Music</i>	<i>Hr.</i>	<i>Theory</i>	<i>Hr.</i>
(Prerequisite: 12 undergraduate hours in Music History and Literature, such as Music 42, 43, 280, 281, 282, 283, or equivalents.)		M. 330—Intro. to Musical Biblio.	3
M. 330—Intro. to Musical Biblio.	3	One of the following	3
M. 331—Seminar in Musicology	3	M. 332—Music in Middle Ages—3	
M. 332—Music in Middle Ages	3	M. 333—Music in Renaissance—3	
M. 333—Music in Renaissance	3	M. 336—Music in Baroque Period—3	
M. 336—Music in Baroque Period	3	M. 337—Music in Classic and	
M. 337—Music in Classic and		Romantic Periods—3	
Romantic Periods	3	M. 349—Psychology of Music	3
M. 367—Analytical Techniques	3	M. 367—Analytical Techniques	3
M. 397—Research (thesis)	4	M. 370—Orchestration	2
Electives*	5	M. 375—Pedagogy of Theory	3
		M. 381—Nonserial Techniques of	
		20th Century Composition	2
		M. 382—Serial Techniques	2
		M. 397—Research (thesis)	4
		Electives	5
	<hr/> 30		<hr/> 30

<i>Music Education (with thesis)</i>	<i>Hr.</i>	<i>Applied Music</i>	<i>Hr.</i>
M. 310—Conducting	3	M. 300—Applied Music	
M. 340—Choral Techniques, or		(major instrument)	8
M. 342—Instrumental Techniques	2	Two of following courses:	6
M. 344—Music Education	3	M. 332—Music in Middle Ages—3	
M. 346—Introduction to Research in		M. 333—Music in Renaissance—3	
Music Education	3	M. 336—Music in Baroque Period—3	
M. 397—Research (thesis)	4	M. 337—Music in Classic and	
Music Electives (at least one course		Romantic Periods—3	
each in theory and music history)* 15		M. 282—Studies in Contemporary	
		Music—3	
		A course (or courses from the Theory	
		and/or Composition offerings—	
		minimum	3
		One of following courses:	2
		M. 396—Lecture Recital—2	
		M. 397—Research—2	
		M. 398—Recital	4
		Music Electives (no more than 4 hr.	
		in the major applied music area)	7
	<hr/> 30		<hr/> 30

*To be eligible for graduation the candidates must demonstrate completion of grade level 8 on their major instrument.

<i>Composition</i>	<i>Hr.</i>
One of following	3
M. 332—Music in Middle Ages —3	
M. 333—Music in Renaissance—3	
M. 336—Music in Baroque Period—3	
M. 337—Music in Classic and Romantic Periods—3	
M. 367—Analytical Techniques	3
M. 360—Composition	6
M. 370—Orchestration	2
M. 375—Pedagogy of Theory	3
M. 381—Nonserial Techniques of 20th Century Composition	2
M. 382—Serial Techniques	2
M. 397—Research (thesis)	4
Electives	5
	<hr/> 30

THE DEGREE OF DOCTOR OF PHILOSOPHY

Admission. Applicants to the program leading to the degree of Doctor of Philosophy must present necessary credentials for evaluation of previous training and experience to the Admissions Committee of the Division of Music. This includes a score on the Miller Analogies Test, a transcript of all grades, and must show proof that the applicant has had a minimum of 28 semester-hours in liberal arts studies. Prior to admission to the program the Committee may, at its discretion, require the applicant to take entrance tests in various fields of music, or the I.E.R. Intelligence Scale "C.A.V.D." test (or some similar test of mental ability), or it may require the applicant to present himself for a personal interview, or any of the three. Under normal circumstances the applicant must have attained an average grade of B in courses taken for his Master's degree. However, if sufficient professional experience should warrant, the Committee may waive the requirement of a B average or may grant an applicant conditional admittance subject to the satisfactory completion of certain specified courses or the attainment of a specified grade-point average within a semester's work.

Candidacy. Graduate students meeting the requirements of the Division of Music and the general requirements of the Graduate School will be recommended to the Dean of the Graduate School for admission to candidacy for the degree. These requirements are:

1. Demonstrate the ability to read German and French. (Upon the recommendation of the adviser and with the approval of the Dean of the Graduate School, one other language may be substituted for French or German).
2. Pass written examinations satisfactorily to show:
 - a. Broad knowledge in "Theory" and "Music History and Literature."
 - b. Knowledge in depth in the field of specialization.
3. Pass satisfactorily a comprehensive oral examination covering the entire field of music.
4. Present and have accepted an outline and prospectus of the dissertation.

Graduate students who have met these requirements and who have maintained an average of B in courses completed shall be admitted to candidacy. Should the applicant fail the written examinations he may apply to take them again after a minimum period of three months. Should the applicant fail the comprehensive oral examination he may be examined again after a minimum period of six months. The results of the second oral examination will be considered final.

Fields of Specialization. Candidates shall select a program within one of the following fields of specialization: (1) Theory; (2) Composition; (3) Music Education; (4) Musicology. In addition, a minor field consisting of a minimum of 12 credit hours in another field of music or a cognate field will be required of all candidate's and will be chosen with the approval of the adviser. If the candidate's specialization is in Musicology, the minor field will ordinarily be chosen from an appropriate area of Humanities.

Curriculum. The exact amount and nature of course work to be undertaken by a candidate will be determined by the adviser with the approval of the doctoral committee in the light of the candidate's previous preparation and his field of specialization.

Residence. In general, the requirements for the degree of Doctor of Philosophy contemplate at least three years of full-time graduate work. A minimum of two semesters is required in residence in full-time graduate study at West Virginia University beyond the master's degree or its equivalent.

Dissertation. The candidate must submit a dissertation produced at West Virginia University under the direction of a major professor which demonstrates a high order of independent scholarship, originality, competence in research, and an original contribution to the field of specialization. If the candidate's field of specialization is Composition the dissertation will be an original, major (*i.e.*, full-length) composition such as a symphony, concerto, chamber opera, oratorio, symphonic poem, etc.

Final Examination. If the candidate's dissertation is approved and he has fulfilled all other requirements, he will be admitted to the final oral examination before his doctoral committee. At the option of his committee, a written examination may also be required. The final examination(s) shall be concerned with the dissertation, its contribution to knowledge, and the candidate's grasp of his field of specialization and its relation to other fields.

Time Limitation. Requirements for the degree of Doctor of Philosophy must be completed within seven years.

THE DEGREE OF DOCTOR OF MUSICAL ARTS IN PERFORMANCE AND LITERATURE

Admission. Applicants to the program leading to the degree of Doctor of Musical Arts must present necessary credentials for evaluation of previous training and experience to the Doctoral Admissions Committee of the Division of Music. This includes copies of programs of recent major recitals, a transcript of all grades, and must show proof that the applicant has had a minimum of 28 semester hours in liberal arts studies. The applicant must also be approved for the program by an Audition Committee, by giving evidence of superior performance, artistic maturity, and extensive repertoire as specified in "Graduate Applied Music Requirements." The Audition Committee shall consist of the Director of the Division of Music, the Chairman of the Applied Music Department, and the major professors involved with the degree. To be admitted to the program the applicant must have attained an average grade of B in courses taken for his Master's degree.

Candidacy. Graduate students meeting the requirements of the Division of Music and the general requirements of the Graduate School will be recommended to the Dean of the Graduate School for admission to candidacy for the degree. These requirements are:

1. Demonstrate minimal acquaintance with German and French by the completion of German 2 and French 2 (or their equivalents) with a grade of "C" or better. (Students may petition to substitute Italian or Spanish for French.)
2. Pass written examinations satisfactorily to show:
 - a. Broad knowledge in Theory and Music History and Literature.
 - b. Knowledge in depth in the literature of the field of specialization.
3. Pass satisfactorily a comprehensive oral examination covering the entire field of music.
4. Present a public recital.

Graduate students who have met these requirements and who have maintained an average of B in courses completed shall be admitted to candidacy. Should the applicant fail the written examinations he may apply to take them again after a minimum period of three months. Should the applicant fail the comprehensive oral examination he may be examined again after a minimum period of six months. The results of the second oral examination will be considered final.

Fields of Specialization. The degree of Doctor of Musical Arts is offered in the area of Performance and Literature in the fields of Specialization of (1) Piano, (2) Voice, and (3) Organ.

Curriculum. The exact amount and nature of course work to be undertaken by a candidate will be determined by the adviser with the approval of the Doctoral Committee in the light of the candidate's previous preparation and his field of specialization.

Residence. In general, the requirements for the degree of Doctor of Musical Arts contemplate at least three years of full-time graduate work. A minimum of two semesters is required in residence in full-time graduate study at West Virginia University beyond the Master's degree or its equivalent.

Recitals, Performance, and Research. Recital, performance, and research requirements should be the *equivalent* to approximately 20 credit hours. A prospectus indicating the various performances and/or projects to be presented for the satisfaction of these requirements will be drawn up by the candidate with the help of his major professor, and submitted to his doctoral committee for approval. (Approximate credit-hour *equivalents* to be established by the candidate's committee are: solo recital, 3-5; written research project, 3-5; major opera role, 2-4; lecture recital, chamber music program, concerto, major oratorio role, 2.) This prospectus should display a variety of kinds of music and types of presentations appropriate for the preparation of an artist-teacher, and may include solo recitals, lecture recitals, chamber music programs, concerto performances, major roles in opera or oratorio, or written research projects. It would include two solo recitals and normally will include either a research project or at least one lecture recital.

Final Examination. If the candidate's project (if any) and recitals are approved and he has fulfilled all other requirements, he will be admitted to the final oral examination before his Doctoral Committee. At the option of his Committee, a written examination may also be required. The final examination(s) shall be concerned with the project (if any) and the candidate's grasp of his field of specialization and its relation to other fields.

Time Limitation. Requirements for the degree of Doctor of Musical Arts must be completed within seven years.

THE DEGREE OF DOCTOR OF EDUCATION

The degree of Doctor of Education is offered in cooperation with the College of Human Resources and Education. The sequence of prerequisites to admission, prerequisites to candidacy, and requirements for the degree are set out in the Education section of this bulletin. The requirements for the degree of Doctor of Education for students in music are identical with those for students in education, except that, for students in music, a maximum of 24 semester hours of graduate work pursued in fulfillment of the requirements for the Master's degree or its equivalent, if of suitable character and quality, may be credited toward the doctorate.

Music

Applied Music

300. **Applied Music.** I, II. 1-4 hr. Open to qualified students in any field in Applied Music. Course number may be repeated as many times as necessary or desirable. A student must demonstrate ability of grade-level 4 on an instrument to receive credit in Music 300 on that instrument. Students other than music majors may take a maximum of one 30-minute lesson per week at one hour credit.
309. **Master Class in Applied Repertoire.** I, II. 2 hr. PR: Consent. A master class designed to give coverage through performance of the literature of a specific Applied Music field. Course may be repeated for credit.

Conducting

- 310. **Conducting. I.** 3 hr. PR: Music 184 or equiv. A graduate course in instrumental and choral conducting. Major works are prepared and conducted through the use of recordings and the large University music organizations.
- 311. **Conducting. II.** 3 hr. PR: Music 310.

Literature

- 220. **Repertoire. I.** 0-2 hr.
- 221. **Repertoire. II.** 0-2 hr.
- 280. **Survey of Operatic Music. I.** 3 hr. PR: Music 42-43.
- 281. **Survey of Symphonic Music. II.** 3 hr. PR: Music 42-43.
- 282. **Studies in Contemporary Music. I.** 3 hr. PR: Music 42-43.
- 283. **Survey of Chamber Music.** 3 hr. PR: Music 42-43.
- 284. **Collegium Musicum. I, II.** 1-2 hr. Performance of outstanding musical works not in the standard repertory. Although open as a performance group to upper-classmen, graduate students will select appropriate vocal and instrumental music, investigate modes of performance, prepare any necessary editions, and direct rehearsals under supervision. May be repeated for credit.
- 323. **Keyboard Literature. S.** 3 hr. PR: Music 220-221. An intensive study of the literature for keyboard instruments and the history of the literature.
- 324. **Song Literature. S.** 3 hr. PR: Music 220-221. An intensive study of the Art Song and the Lied and the history of their development.
- 325. **Choral Literature.** 3 hr. PR: Music 220-221. An intensive study of the body of choral music and the history of its development.
- 330. **Introduction to Musical Bibliography. I.** 2-3 hr. PR: Music 42-43 or equivalent. A survey of important areas of musical bibliography with appropriate research assignments.
- 331. **Seminar in Musicology. II.** 3 hr. PR: Music 330. Musical research and investigation. Special fields of study will be selected for each term and individual projects undertaken. Course may be repeated for credit.
- 332. **Music in the Middle Ages. I.** 3 hr. PR: Music 42-43 or equiv. and consent. A detailed study of the music and musical practice from the beginning of the Christian era to 1400.
- 333. **Music in the Renaissance. II.** 3 hr. PR: Music 42-43 or equiv. and consent. Continuation of Music 332 through the sixteenth century.
- 336. **Music in the Baroque Period. I.** 3 hr. PR: Music 42-43 or equiv. and consent. A detailed study of the music and musical practice of the period from 1600 to 1750.
- 337. **Music in the Classic and Romantic Periods. II.** 3 hr. PR: Music 42-43 or equiv. and consent. Continuation of Music 336 covering the period from 1750 to 1900.
- 338. **History of Notation. S.** 3 hr. PR: Music 42-43 or equiv. A detailed study in transcribing the musical manuscripts of the Middle Ages.
- 339. **History of Notation. S.** 3 hr. PR: Music 42-43 or equiv. Continuation of Music 338 covering the Renaissance Period.

Church Music

- 329. **Survey of Sacred Music. S.** 4 hr. PR: Music 42-43 or equiv. A study of music suitable to the liturgical year, including the historical background of the Jewish, Catholic, and Protestant liturgies.

Music Education

- 200. **Band, Orchestra, Choral, Opera Theatre, and Music Education Clinics.** 2 hr. Special problems of organization and development of the various performing organizations. Lecture, laboratory, and discussion groups.
- 201. **Music in the Elementary School.** 2 hr. PR: Music 10, 11, 12, or consent. Development of skills, procedures, techniques, and materials used by the general classroom teacher of music in grades 1-8. Not open to music majors.
- 246. **Music in the Junior High School.** 2 hr. PR: Music 181-182 or equiv. A consideration of the potentialities and special needs of the junior high school in music education; programs, procedures, and materials.
- 340. **Choral Techniques. II.** 2 hr. PR: Music 181-182 or equiv. A study of advanced techniques and procedures involved in the development of ensembles.
- 342. **Instrumental Techniques. I.** 2 hr. PR: Music 181-182 or equiv. A study of advanced techniques and procedures involved in individual performance and instruction through lecture-demonstrations by the applied music faculty.
- 344. **Music Education. II.** 3 hr. PR: Music 181-182 or equiv. Survey and critical study of the total music education program.
- 345. **The Supervision of Music.** 2 hr. PR: Music 181-182 or equiv. Problems in the supervision of music in the elementary grades and in junior high school.
- 346. **Introduction to Research in Music Education. I.** 3 hr. PR: Music 181-182 or equiv. A study of various subjects and techniques of value in research in music education.
- 348. **Psychology of Music Learning. II.** 3 hr. The application of learning theory to music learning; the nature of musical talent; music talent testing.
- 349. **Psychology of Music. I.** 3 hr. An introductory study of musical acoustics and psychology of perception of music.
- 351. **Music in Society.** 2 hr. PR: Music 42-43 or consent. The function throughout history of music in society; the relation between social factors and musical practice.
- 352. **Aesthetics of Music. II.** 2 hr. PR: Music 42-43 or consent. An examination of the main classical and contemporary aesthetic theories and their applications to music.

Opera

- 210. **Opera Theatre. I, II.** 0-4 hr. PR: Music 20 or consent. Continuation of Music 20. Performance of major roles and advanced production techniques. Qualified students will undertake production-direction projects under supervision.

Theory and Composition

- 252. **Analysis of Musical Form. I.** 3 hr. PR: Music 8. A detailed study of the structure of music.
- 253. **Counterpoint. I.** 2 hr. PR: Music 8 or consent. Sixteenth century counterpoint.
- 254. **Counterpoint. II.** 2 hr. PR: Music 8. Eighteenth century counterpoint.
- 256. **Upper Division Composition. I, II.** 2 hr. PR: Four semesters Music 114, or consent based on scores submitted. Creative writing with emphasis on practical composition for performance. May be repeated for credit.
- 360. **Composition. I, II.** 3 hr. PR: Consent. A course primarily for candidates for the graduate degrees in Theory or Composition. Course may be repeated for credit.
- 367. **Analytical Techniques. I.** 3 hr. A study of various theories of musical analysis and their application.

370. **Orchestration.** I, II. 2 hr. PR: Music 118 or equiv. Major projects of orchestration. Course may be repeated for credit; maximum credit 6 hours.
371. **Computer Applications in Music.** I. 3 hr. Computer programming and a survey of computer applications in music.
372. **Band Arranging.** II. 2 hr. PR: Music 118 or equiv. Major projects in arranging for the concert band.
375. **Pedagogy of Theory.** II. 3 hr. PR: Music 8 and consent. Consideration of the various approaches to the teaching of theory.
381. **Nonserial Techniques of 20th Century Composition.** I. 2 hr. A theoretical and analytical course including the application of various techniques in student compositions.
382. **Serial Techniques.** II. 2 hr. A theoretical and analytical course including the application of serial techniques in student compositions.
383. **Remedial Theory.** I, II. 0 hr. A course for graduate students who are deficient in undergraduate theory requirements.

Research or Recital

392. **Advanced Studies in Music.** I, II. 2-8 hr. PR: Consent of the instructor which in some cases may be contingent upon doctoral foreign language examinations. Primarily intended for Ph.D. candidates. Intensive individualized reading reported in group discussions. Course may be repeated as many times as necessary, in as many areas as needed, and several different sections (i.e. areas) may be pursued simultaneously.
393. **Recital.** 2 hr. For Music Education majors only.
394. **Doctoral Seminar.** I, II. 2 hr. PR: Consent. Intensive individual investigation and preparation of research papers or compositions. Course may be repeated for credit; maximum credit 8 hours. Presented by the combined doctoral staff in music.
395. **Dissertational Guidance.** I, II. 1-12 hr. Credit not to be applied toward the Ph.D. or Ed.D.
396. **Lecture Recital.** 2 hr.
397. **Research.** I, II. 1-15 hr. The student may enroll in this course any number of times approved by his department.
398. **Recital.** 1-4 hr. PR: Music 299 or equiv.

APPLIED MUSIC REQUIREMENTS*

Major Instrument

Applied Music Majors. All entering graduate students majoring in Applied Music must demonstrate by audition grade-level 10 ability on their major instrument to be accepted for that degree.

Music Education, History of Music. All entering graduate students majoring in these areas must demonstrate by audition grade-level 7 ability on their major instrument, and to be eligible for graduation must demonstrate grade-level 8 ability.

Theory, Composition. All entering graduate students majoring in these areas must demonstrate by audition grade-level 8 ability on their major instrument.

Doctor of Philosophy. All entering graduate students for the Ph.D. must demonstrate performance ability on the major instrument to the satisfaction of the Admissions Committee.

*Graduates of the Division of Music may enter on their past record of grade-level achievement without audition, unless it is deemed necessary by the Director of the Division of Music.

Piano

Music Education. All entering graduate students in Music Education must demonstrate Piano ability to satisfy either grade-level 2B or 3.

Theory, Composition. All entering graduate students majoring in these areas must demonstrate Piano ability to satisfy grade-level 4.

Applied Music, History of Music. All entering graduate students majoring in these areas must demonstrate Piano ability to satisfy grade-level 3.

COURSES IN APPLIED MUSIC

See the office of the Division of Music for a listing of applied music courses on the graduate level.

DIVISION OF ART

Candidates for the Degree of Master of Arts in Art must have an undergraduate major or minor in art, a teaching field in art, or the equivalent. Before being admitted to candidacy for the degree the student will take a comprehensive examination in the field and a test designed to demonstrate his ability to do graduate work, and any deficiency in preparation must be made up without graduate credit.

Divisional requirements for the degree are as follows:

1. Completion of a minimum of 30 semester hours of graduate work, including not more than 6 hours in thesis or problem.
2. Passage of a written comprehensive examination.
3. Completion of Art 290, Study of Original Works of Art (6 hours).
4. Passage of an oral examination on the thesis or problem.

Of the 30 hours, not more than 9 may be in studio courses.

With the consent of his committee, the student may elect a maximum of 6 hours in a related subject.

Art

211. **Figure Drawing.** I, II, S. 3 hr. PR: Art 11 or 111, 12 or 112, and/or consent. Study of the construction of the figure. Drawing from the draped and partially draped model.
213. **Painting.** I, S. 3 hr. PR: Art 113, 117 and consent. First semester advanced watercolor.
214. **Painting.** I, II, S. 3 hr. PR: Art 213 and consent. Second semester advanced watercolor.
216. **Painting.** II, S. 3 hr. PR: Art 114, 118, and consent. First semester advanced oil painting.
217. **Painting.** I, II, S. 3 hr. PR: Art 216 and consent. Second semester advanced oil painting.
220. **Art and the School.** I, II, S. 2 hr. PR: 4 hr. of Art, including a minimum of 2 hr. studio. The functioning of art in the curriculum at various grade levels and a study of standards of achievement.
221. **Administration and Supervision of Art.** I, II, S. 2 hr. PR: Art 220. Mainly for administrators and school principals who wish to become informed about all programs and the philosophies underlying them.

225. **Secondary School Art. I or II, S. 3 hr. PR:** Art 11 or 111, 12 or 112, 121, 122, 113, 114, and consent. Information and working skills desirable for the teaching of art on the secondary school level.
241. **Medieval Architecture. I, II, S. 3 hr. PR:** Art 105, 106. A study of architecture from the time of Constantine to the Renaissance.
250. **Renaissance Painting. I. 3 hr. PR:** Art 105, 106. A study of painting in Italy from Cimabue to Tiepolo; the Renaissance in Western Europe; a brief consideration of baroque and rococo painting as outgrowth of the Renaissance. Offered alternate years.
260. **Modern Painting. II, S. 3 hr. PR:** Art 105, 106. Developments in painting from the French Revolution to the present day.
271. **American Architecture. I, II, S. 3 hr. PR:** Art 105, 106. Developments in architecture in North America from Pre-Columbian times to the present day. Emphasis will be placed on the architecture of the United States. Offered alternate years.
275. **Latin American Art. I, II. 3 hr. PR:** Consent of the instructor. Art from Pre-Columbian times to the present. Outstanding examples of the various periods will be considered. Offered alternate years.
290. **Study of Original Works of Art. S. 6 hr. PR:** Art 105, 106, and consent of the Division. Directed study of the museums and libraries of some urban center such as Washington or New York; a study of the architectural developments of the locality. Offered alternate years.
- 350, 351. **Special Topics. I, II, S. 1-3 hr. per sem. PR:** Consent of the Division. Individual study to be determined by the student's requirements.
397. **Research. I, II, S. 1-15 hr. (thesis, 6 hr.). PR:** Approval of Student's Committee.

DIVISION OF DRAMA

THE DEGREE OF MASTER OF ARTS

Persons who possess a bachelor's degree from an accredited college or university may be admitted to the program. Any deficiencies in undergraduate preparation in upper-division courses in Drama appropriate to the anticipated area of specialization will be made up either without credit or (in instances of 200 or above numbered courses) added to the credit required for the degree.

1. Successful completion of the minimum number of required graduate hours as set forth in Program "A" or Program "B" below.
2. Completion, within the framework of the Graduate School and Division of Drama standards, of one of the two following programs of study:
 - A. Concentration program which meets the following requirements:
 - (1) Successful completion of at least a minimum of 30 semester hours of graduate credit. No more than 9 of the 30 credit hours will be in research and thesis.
 - (2) Successful passage of comprehensive written examination in the fields of study. Such examinations are administered toward the end of the student's course work and then only if and when the student has a "B" grade-point average or 75 per cent of his credit hours are of "B" grade or higher.
 - (3) Submission for approval by the student's graduate committee of a thesis demonstrating original research and scholarly reporting.
 - (4) Successful completion of an oral examination on the thesis.

B. General program which meets the following requirements:

- (1) Similar to above program (A) with a total of 36 hours required. The six additional hours to be substituted for the thesis requirement and to be taken in drama or cognant fields upon the approval of the faculty adviser.
 - (2) Successful passage of comprehensive examinations, both written and oral, in all areas of Drama. Either a 3.0 (B) grade-point average or 75 per cent of "B" grades for the hours carried is prerequisite to taking comprehensive examinations.
3. The student pursuing Program A or Program B will emphasize either a directing or a design specialty, oriented toward a professional or teaching career in drama.

Drama

202. **Scene Design. II.** 3 hr. PR: Drama 100, 102, or consent. Lecture and laboratory in theories of scene design for stage and television, including actual construction of designs. Open to juniors, seniors, and graduate students.
203. **Advanced Theatre Lighting Design. II.** 3 hr. PR: Drama 103 or consent. Advanced theories of lighting and design for the stage. Course includes practical experience with advanced lighting equipment.
204. **Advanced Costume Design. II.** 3 hr. PR: Drama 104 or consent. Individual study in design styles and techniques. Survey of the position of costume design in theatre today.
250. **Advanced Problems in Interpretation. II.** 3 hr. PR: Drama 50 and consent. Designed to deal with individual problems of advanced students in interpretation.
251. **Professional Reading. I, II.** 3 hr. PR: Consent. Intensive training in interpretation. Designed to meet needs of individual. Full length public recital prepared and presented. Limited enrollment.
252. **Art of Storytelling. S.** 3 hr. PR: Consent. Principles involved in effective presentation of stories, with practical experience in classroom and before audiences. Stories of all types for adults and children studied.
260. **Theatre Performance and Rehearsal Laboratory. I, II.** 1 to 3 hr. PR: Drama 161 or consent. Participation in assigned theatre projects. Appreciation of creativity and performance techniques in theatre. Majors only. Maximum credit, 6 hr.
275. **Advanced Acting. II.** 3 hr. PR: Drama 75 and consent. Characterization, script analysis, style, theories, and techniques. Designed to meet needs of individual student.
280. **Advanced Play Directing. II.** 3 hr. PR: Drama 180, or consent. Emphasis on work of directing as an integrating artist. Display of high level of proficiency in direction of a one-act play required of all students enrolled.
281. **Theatrical Dialects. I.** 3 hr. PR: Consent. Study and mastery of 15 common dialects used in theater and radio.
282. **Creative Dramatics. I.** 3 hr. PR: Drama 75 or consent. The study and practice of creative dramatic activity as a method of learning and self development for children.
283. **Playwriting. II.** 3 hr. PR: Consent. Development of creative ability in dramatic composition. Study of techniques and problems of playwriting. Of cultural value, but primarily a writing course.
285. **Advanced History of Theater. II.** 3 hr. Historical survey of theater from primitive time to present. Includes both oriental and occidental theaters.

286. **Drama Criticism and Aesthetics. I.** 3 hr. A survey of chief critical and aesthetic theories of drama-ancient, modern contemporary.
287. **Styles of Acting and Directing. II.** 3 hr. PR: Drama 180, Drama 175 or consent. Extensive and intensive study of directing and acting styles.
300. **Applied Creative Performance.** 3 hr. Creative projects and/or performance. Must have faculty approval as part of student's graduate program.
331. **Research Methods and Survey.** 3 hr. PR: Consent. Research methods and techniques and general survey of the field of drama.
344. **Survey of Educational Methods and Practices.** 3 hr. Survey and critical study of the total drama education program.
360. **Specialized Seminars.** 3-9 hr. PR: Consent. Selected fields of study in drama. (May be repeated for a maximum of 9 credit hours).
397. **Research. I, II.** 1-15 hr. Student may enroll in research or thesis with consent of adviser.

Engineering and Mines

REQUIREMENTS FOR ADMISSION

A student desiring to take courses for graduate credit in the College of Engineering must first comply with the appropriate regulations of the Graduate School.

A student who intends to become a candidate for a degree must apply for admission through the Office of Admissions to the major department of his choice. Acceptance by the major department will depend upon review of the student's academic background and the available facilities in the department.

An applicant with a baccalaureate degree, or its equivalent, from a department accredited by the Engineers' Council for Professional Development will be admitted on the same basis as engineering graduates of West Virginia University. Lacking these qualifications, an applicant must first fulfill the requirements of the department in which he is seeking an advanced degree.

Admission to candidacy for a graduate degree is required prior to obtaining that degree. A graduate student may apply for admission to candidacy by formal application after completing a minimum of 12 semester hours of graduate courses with a grade-point average of at least 3.0, based on all graduate courses, taken in residence, for which he has received a grade at the time of application.

ACADEMIC STANDARDS AND CURRICULA

No credits which are reported with a grade lower than C are acceptable toward an advanced degree.

To qualify for an advanced degree, the graduate student must have a grade-point average of at least 3.0 based on all courses acceptable for graduate credit for which he has received a grade from the University.

Each candidate for a degree must select his major subject in that department in which his degree is taken:

Ph.D. Degree—See departmental descriptions.

M.S. Degree—Each department has a designated M.S. degree and in addition the College has an undesignated degree, Master of Science in Engineering. For all M.S. degrees each candidate will, with the approval of his graduate committee, follow a planned program which must conform to one of the following outlines:

1. A minimum of 30 semester credit hours, not more than 6 of which are in research leading to an acceptable thesis.
2. A minimum of 33 semester credit hours, not more than 3 of which are in research leading to an acceptable problem report.
3. A minimum of 36 semester credit hours, with no thesis or problem report required.

At least one-half of the courses taken, exclusive of research, must be in the College of Engineering with as many as possible at the 300 level.

A graduate student in the College of Engineering must comply with the regulations of his major department.

MASTER OF SCIENCE IN ENGINEERING

This interdepartmental degree program is designed for students who desire to pursue work in areas other than that of their baccalaureate degree in engineering or science. Graduate students who wish to become candidates for this degree should register with the department in which the major portion of the work is to be done.

Admission and Academic Standards. Students must comply with the rules and regulations as outlined under Requirements for Admission and Academic Standards for graduate work in the College of Engineering.

Adviser and Examining Committee. Each student will be assigned an adviser and an advisory and examining committee will be appointed by the department in which the major portion of the work is to be done.

Final Examination. On completion of the course requirements a candidate for the degree of Master of Science in Engineering shall be required to pass a final examination which may be written, or oral, or both, covering both course material and the thesis or problem report, depending upon the option selected.

THE DEGREE OF DOCTOR OF PHILOSOPHY

Admission. Admission to the Graduate School of West Virginia University is required of all applicants for admission to a program of study and research leading to the Ph.D. Applicants for admission are expected to have successfully completed a Bachelor of Science or Master of Science degree program in some phase of engineering equivalent to the program leading to this degree in effect at West Virginia University. Admission to the Graduate School does not necessarily assure entrance into the College of Engineering Ph.D. program. Formal admission to the Ph.D. program is granted by the Graduate Programs Executive Committee after review of a student's petition which includes a record of his academic performance and a proposed program of study.

Requirements for Candidacy. After admission to the program and after a period of residence, the applicant will be admitted to a comprehensive preliminary or qualifying examination (either oral or written or both) in which he must demonstrate: (a) a grasp of the important phases and problems of the field of study in which he proposes to major and an appreciation of their relation to other fields of human knowledge and accomplishments; and (b) the ability to employ rationally the instruments of research developed in his major field. In addition, the student must satisfy the foreign language requirements of the Graduate School.

When an applicant has successfully passed his comprehensive examination he will be formally admitted to candidacy for the Doctor's degree. Admission to candidacy must precede the final examination for the Doctor's degree. Graduate courses pursued in fulfillment of the requirements for the Master's degree, if of suitable character and quality, may be credited toward the doctorate.

Curriculum. The degree of Doctor of Philosophy is not awarded for the mere accumulation of course credits nor for the completion of a definite residence requirement. The exact amount and nature of the course work to be undertaken by a candi-

date will be established for each individual candidate with the object of insuring a rational and coherent progression of academic development beyond the Bachelor of Science degree.

Residence. The requirements for the degree of Doctor of Philosophy contemplate approximately three years of full-time graduate work beyond the Bachelor's degree. A minimum of 36 weeks in residence in full-time graduate study or its equivalent at West Virginia University is required, and must include a minimum of two semesters at the University.

Dissertation. The candidate must submit a dissertation on a topic within the area of his major interest. The dissertation must represent the results of independent research and must constitute a definite contribution to knowledge. It is anticipated that the work leading to the completion of the dissertation would require 24 hours in research and/or dissertation credits or satisfactory evidence of equivalent time devoted to research and preparation of the dissertation.

Final Examination. Upon completion and approval of the dissertation and fulfillment of all other requirements, the candidate shall pass a final examination conducted by a committee of at least five members recommended by the major department and appointed by the Dean of the Graduate School. The examination shall be primarily a defense of the dissertation although other questions necessary to establish the validity of the dissertation may be in order.

AEROSPACE ENGINEERING

Master of Science in Aerospace Engineering

Students must comply with rules and regulations as outlined in General Requirements for graduate work in the College of Engineering.

Thesis. Normally a thesis is required of all candidates for the degree of Master of Science in Aerospace Engineering. Approval by the Advisory and Examining Committee is necessary before the thesis will be accepted. The thesis must be presented in a form that conforms to general requirements of the Graduate School, and in addition should conform to additional thesis requirements of the Department of Aerospace Engineering.

Whether or not a thesis is required shall be determined by the department and shall be recorded in the student's file as a part of his planned program.

Final Examination. Each candidate for the Master's degree shall pass a final examination administered by his Advisory and Examining Committee.

Courses. The following grouping of courses is given as a guide for selecting a graduate program leading to the degree of Master of Science in Aerospace Engineering:

Group I. Required of all candidates. Six semester credit hours of advanced mathematics beyond a first course in differential equations.

Group II. Major. Minimum of 9 semester hours of Aerospace Engineering courses, other than A.E. 397, in the 300 series.

In order to meet the minimum requirements for the degree of Master of Science in Aerospace Engineering, additional courses may be taken from the following, subject to the approval of the student's Advisory and Examining Committee:

1. Courses from Groups I and II.
2. Aerospace Engineering courses in the 200 series which are not required for the degree of Bachelor of Science in Aerospace Engineering of West Virginia University.
3. Physics and Chemistry courses in the 200 or 300 series.
4. Courses in other departments of the College of Engineering in the 200 or 300 series.

The Degree of Doctor of Philosophy

A candidate for the degree of Doctor of Philosophy must comply with the rules and regulations as outlined in General Requirements for graduate work in the College of Engineering.

Candidates for the Doctor of Philosophy degree, regardless of their specific major, may be required to attain a proficiency in each of the following areas: (1) fluid mechanics, (2) thermodynamics, and (3) applied mathematics.

The research work for the doctoral dissertation must show a high degree of originality on the part of the student and must constitute an original contribution to the field of Aerospace Engineering. It must have good literary form and style, and must give a thorough survey of prior literature in the subject. The candidate is required to take a final oral examination upon completion of the dissertation in defense of his research.

Aerospace Engineering

- 200. **Inspection Trip.** (Credit).
- 203. **Applied Aerodynamics.** 3 hr. PR: A.E. 209. Chordwise and spanwise airload distribution for plain wings, wings with aerodynamics and geometric twist, wings with deflected flaps, and wings with ailerons deflected. Section induced drag characteristics. 3 hr. lec.
- 207. **Flight Vehicle Design.** 3 hr. PR: A.E. 209. Preliminary design of flight vehicles. Vehicles are designed with regard for performance and stability requirements, considering aerodynamics, weight and balance, structural arrangement, configuration, guidance, and propulsive effects. Layout drawings and calculations are combined in a preliminary design report. 1 hr. lec., 6 hr. lab.
- 209. **Flight Mechanics.** 3 hr. PR: A.E. 221. Performance estimation with emphasis on fixed wing aircraft. Fundamental concepts of stability and control of aircraft. 3 hr. lec.
- 210. **Flight Vehicle Structures. I.** 3 hr. PR: T.A.M. 102. Strength of thin walled structures in bending, shear, and torsion. Strain energy and application of Castigliano's theorem to bending of rings and curved bars, and to analysis of frames. Principle of virtual work and its application to beam and truss deflections and to statically indeterminate structures. 3 hr. lec.
- 211. **Flight Vehicle Structures. II.** 3 hr. PR: A.E. 210. Tension fields and the design of Wagner beam. Buckling of compression structures: bars, sandwich columns, torsional instability of columns, wrinkling in sandwich construction, plates, shells, and stiffened panels. Design for minimum weight. Introduction to thermal stresses. Failure by fatigue and fracture. 3 hr. lec.
- 212. **Design of Flight Structures. I.** 3 hr. PR: A.E. 207 and A.E. 211. Structural design of flight vehicle members. Layout and detail design of specified components are required. 1 hr. lec., 6 hr. lab.
- 214. **Experimental Fluid Dynamics. I.** 3 hr. PR: A.E. 222. Subsonic and supersonic wind tunnel testing methods and practice. Experiments include the following measurements: pressure distribution on bodies, boundary layer determination, turbulence measurements, force tests, and stability and performance determinations. Corrections for scale and jet boundary effects. Test design, data analysis, and engineering report preparation. 2 hr. lec., 3 hr. lab.
- 215. **Experimental Flight Vehicle Structures.** 2 hr. PR: A.E. 211. Strain gage techniques and instrumentation, stress-strain curves of materials. Tests on box beam in bending and torsion, stiffened panels, stiffened and unstiffened cylinders in compression, vibration of beams, photoelastic method of stress analysis. 1 hr. lec., 3 hr. lab.
- 217. **Design of Flight Structures II.** 3 hr. PR: A.E. 211. Analysis and detail design of simple fittings, beams, welded structures, forgings, castings. Methods of production and fabrication. 1 hr. lec., 6 hr. lab.
- 218. **Aerolasticity.** 3 hr. PR: A.E. 210. The study of vibrating systems of single degree and multiple degrees of freedom, flutter theory and modes of vibration, torsional divergence and control reversal. 3 hr. lec.

219. **Introduction to Research.** 1-3 hr. PR: Senior standing and consent. An introduction to the methods of organizing theoretical and experimental research. Formulation of problems, project planning, and research proposal preparation.
220. **Research Problems.** 2-6 hr. PR: A.E. 219. Performance of the research project as proposed in A.E. 219. Project results are given in written technical reports, with conclusions and recommendations.
221. **Fluid Dynamics. I.** 3 hr. PR: Math. 140 and conc.: A.E. 116, M.E. 120. Properties of the fluid medium, dimensional analysis, hydrostatics, kinematics and dynamics of a fluid field, perfect fluid flow about a body, complex potential function, conformal transformation. 3 hr. lec.
222. **Fluid Dynamics. II.** 4 hr. PR: A.E. 221. Thin airfoil theory, finite wing theory. Introduction to compressible, nonviscous fluids, isentropic flow, Prandtl-Meyer expansion, shock waves, airfoils in compressible flow, small perturbation theory, viscous incompressible flow, boundary layer, exact, and integral solutions, introduction to turbulence. 4 hr. lec.
224. **Flight Vehicle Propulsion.** 3 hr. PR: A.E. 222 or consent. Equilibrium combustion thermodynamics. Quasi one dimensional flow with friction and total temperature change. Thermodynamics of aircraft engines. Aerodynamics of inlets, combustors, nozzles, compressors and turbines. Performance of rockets, ideal rocket analysis. 3 hr. lec.
225. **Guided Missile Systems.** 3 hr. PR: A.E. 222 and/or conc.: A.E. 224. Design philosophy according to mission requirements. Preliminary configuration and design concepts. Aerodynamics effects on missiles during launch and flight. Ballistic missile trajectories. Stability determination by analog simulation. Performance determination by digital and analog simulation. Control guidance and propulsion systems. Operational and reliability considerations. 3 hr. lec.
226. **Fluid Dynamics IV.** 3 hr. PR: A.E. 222. Shock tube theory and applications. Introduction to kinetic theory, the calculation of viscosity and thermal conductivity. Fundamentals of hypersonic flow and the determination of minimum drag bodies. 3 hr. lec.
227. **Advanced Topics in Propulsion.** 3 hr. PR: A.E. 224 or consent. Special problems of thermodynamics and dynamics of aircraft power plants. Chemical rocket propellants and combustion. Rocket thrust chambers and nozzle heat transfer. Nuclear rockets. Electrical rocket propulsion. 3 hr. lec.
230. **Flight Testing.** 3 hr. PR: A.E. 209. Applied flight test techniques and instrument calibration methods, determination of static performance characteristics, and introduction to stability and control testing based on flight test of Cessna Super Skywagon airplane. Flight test data analysis and report preparation. 1 hr. lec., 6 hr. lab.
256. **Experimental Fluid Dynamics. II.** 3 hr. PR: A.E. 214. Continuation of A.E. 214 with increased emphasis on dynamic measurements. Shock tube/tunnel and subsonic and supersonic measurements. Experiments include optional techniques, heat transfer to models, and viscous flow measurements. Error analysis of test data. 2 hr. lec., 3 hr. lab.
258. **Space Mechanics.** 3 hr. PR: Math. 140, T.A.M. 104. An introduction to flight in and beyond the earth's atmosphere by space vehicles. The laws of Kepler and Orbital theory. Energy requirements for satellite and interplanetary travel. Exit from and entry into an atmosphere. 3 hr. rec.
280. **Aerospace Problems.** 1-6 hr. Upper division and graduate.
299. **Thesis.** 2-6 hr. PR: Senior standing and consent.
351. **Dynamics of Viscous Fluids.** 3 hr. PR: Consent. Exact solutions of the Navier-Stokes equations. Laminar incompressible and compressible boundary layer theory, similarity solutions and integral methods. 3 hr. lec.

ERRATA

The following Aerospace Engineering courses for page 129 of the 1969-70 Graduate School *Announcements* were omitted by the printer. Please insert the following courses after A.E. 362 on page 129:

- 363. **Applied Magnetohydrodynamics II.** 3 hr. PR: A.E. 362 or consent. Incompressible and viscous MHD channel flow; plane waves in fluids, discontinuities and MHD shock waves, applications of MHD to electric power generation, etc. 3 hr. lec.
- 372. **Advanced Aeroelasticity.** 3 hr. PR: A.E. 218. Deformation of structures under static and dynamic loads, flutter of straight and swept wings, disturbed motion of an elastic model, dynamic response in gusts and landings, the aeroelastic model theory. 3 hr. lec.
- 373. **Dynamic Loads.** 3 hr. PR: A.E. 203, 218. Dynamics of a particle, lift distribution during accelerated maneuvers, beam bending and torsion with unsteady loads, empennage loads during dynamic flight conditions, landing impact loads. 3 hr. lec.
- 374. **Materials and Theories of Failure.** 3 hr. PR: A.E. 211. Failures in simple stress states, combines stress states; method of fatigue failure, minimum weight structures, evaluation of material to resist design load condition. 3 hr. lec.
- 375. **Advanced Flight Vehicle Structures.** 3 hr. PR: A.E. 211. Incomplete tension fields, critical loads, torsional column failure, instability of flat sheets, cylindrical structure, special methods of analysis. 3 hr. lec.
- 397. **Research.** 1-15 hr. Advanced research or special investigations on some topic relating to aerospace engineering.

353. **Perfect Fluid Theory.** 3 hr. PR: Consent. Use of Lagrangian and Eulerian variables, kinematic properties of rotational flows, Biot-Savart law and applications, conformal mapping including Schwarz-Christoffel and Joukowski transformations. Thin airfoil theory, three dimensional wing theories. 3 hr. lec.
354. **Advanced Flight Mechanics.** 3 hr. PR: A.E. 209, 222. Dynamic stability. Obtaining flight characteristics of the vehicle from dynamic flight test techniques, such as frequency response, and transient response methods. The problems of automatic control. 3 hr. lec.
355. **Gas Dynamics.** 3 hr. PR: A.E. 222. Nonsteady gas dynamics and shock tube theory. Applications of shock tubes in aerospace research. Compressible flow theory in the subsonic, transonic, and supersonic regimes. 3 hr. lec.
356. **Fluid Flow Measurements.** 3 hr. PR: A.E. 222, or consent. The principles and measurements of: static and dynamic pressures and temperatures, velocity and Mach number forces. Optical techniques and photography. Design of experiments. Review of selected papers from the literature. 2 hr. lec., 3 hr. lab.
357. **Special Problems.** 2-4 hr. PR: Consent of department chairman. A course for graduate students in the non-research program. The student will select a specialized field and follow a course of study in that field under the supervision of a counselor.
358. **Space Mechanics.** 3 hr. PR: Math. 245. A.E. 222, 224. Variational formulation of mechanics. Theory of orbits and trajectories with applications to astronomical problems. Introduction to the space environment of the solar system. 3 hr. lec.
359. **Dynamics of Real Gases.** 3 hr. PR: A.E. 351 or consent. Fundamentals of multi-component gas flow from a molecular viewpoint; thermodynamic properties of equilibrium mixtures from statistical mechanics; chemical kinetics; derivation of the gas dynamic conservation equations from Maxwell's transport equation; effects of the chemical model on high-temperature, high-speed flow properties.
360. **Fundamentals of Turbulent Flow.** 3 hr. PR: A.E. 351 or consent. Survey of the basic experimental data. Application of the semi-empirical theories to pipe, jet and boundary layer flow. Turbulent heat and mass transfer. Statistical theory of turbulence and recent applications. Hydrodynamic instability and its relation to transition. 3 hr. lec.
362. **Foundations of Magnetohydrodynamics I.** 3 hr. PR: Consent. Effects of ionization in gas flows; equations of state, charge, mass, momentum and energy conservation; effects of self-generated and external electric and magnetic fields on electrically conducting fluids and transport coefficients. 3 hr. lec.

AGRICULTURAL ENGINEERING AND FOREST ENGINEERING

Master of Science in Agricultural Engineering

A. D. Longhouse, *Program Director*

Before being admitted to graduate work in the Department of Agricultural Engineering, the prospective student must be admitted to the Graduate School. Candidates for the M.S. in Agricultural Engineering degree must first satisfy the requirements of the B.S. in Agricultural Engineering degree or its equivalent from a recognized agricultural engineering department. In general, candidates must meet the requirements of the B.S. in Agricultural Engineering degree, but candidates who have an engineering degree other than the B.S. in Agricultural Engineering degree may choose the M.S. in Engineering degree and need not satisfy or remove the requirements for the B.S. in Agricultural Engineering degree.

Thesis. A thesis is required of all candidates for the M.S. in Agricultural Engineering degree or M.S. in Engineering degree. In most cases it will be necessary to

take 6 hours of research work, Agricultural Engineering 397. A thesis, however, is not automatically approved after the required number of semester hours of research work has been completed. The candidate may find that completion of the thesis for approval will delay his originally anticipated date of graduation. The major subject, including thesis, must be taken in the Department of Agricultural Engineering. Candidates may specialize in power and field machinery, soil and water conservations, farm structures, or electric power and processing. On satisfactory completion of his thesis and course work, the candidate will be given an examination by his special committee.

Thesis Supervisor. Each student will be assigned a thesis supervisor who will serve as chairman of his graduate committee.

Agricultural Engineering

- 200. Seminar. I. 1 hr. PR: Senior or graduate standing.
- 201. Agricultural Structures. II. 3 hr. PR: T.A.M. 102. Structural design and functional requirements of agricultural buildings. 2 hr. rec., 3 hr. lab.
- 210. Electric Power. II. 3 hr. PR: E.E. 105. Economic application of electric light, heat, and power. 2 hr. rec., 3 hr. lab.
- 220. Agricultural Process Engineering. II. 3 hr. PR: C.E. 115, M.E. 121. Application of the fundamentals of engineering to agricultural engineering processes. 2 hr. rec., 3 hr. lab.
- 230. Farm Power. I. 3 hr. PR: M.E. 121. Fundamental theories underlying design and operation of internal combustion engines used in agriculture. 2 hr. rec., 3 hr. lab.
- 240. Hydrology. I. 3 hr. PR: C.E. 115. Study of a hydrologic cycle with emphasis on precipitation and runoff as related to design of hydraulic structures, soil and water conservation, and flood control. 3 hr. rec.
- 241. Physical Climatology. II. 3 hr. PR: Consent. Physical principles underlying the variations and changes in climate, climatic controls, elements of micro climatology, engineering applications and uses of climatic data. 3 hr. rec.
- 250. Soil and Water Conservation. I. 3 hr. PR: C.E. 115. Engineering principles and practices in conservation, utilization, and management of soil and water resources. 2 hr. rec., 3 hr. lab.
- 290. Elements of Machinery Design. II. 3 hr. PR: M.E. 201. Design requirements for construction, principles of operation and adequate adjustment of agricultural machines and principles of testing agricultural equipment. 2 hr. rec., 3 hr. lab.
- 320, 321. Special Topics. I, II, S. 1-6 hr. (For the Master's degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.).
- 340. Problems in Hydrology. I. 3 hr. PR: Ag. Eng. 240. Consideration of special problems in hydrograph analysis, hydrologic performance of small watersheds, erosion and sedimentation, hydro-meteorological studies, flood runoff and peak discharge, drought, river forecasting, frequency analysis of hydrologic data. Special report. 3 hr. rec.
- 397. Research. I, II, S. 1-15 hr.

Forest Engineering

Master of Science in Engineering

A. D. Longhouse, *Program Director*

Admission. The graduate program in Forest Engineering leads to the degree of Master of Science in Engineering. It is open to graduates of wood science, forest science, or accredited engineering curricula. Students with Bachelor of Science degrees in Forestry, Agriculture, Mathematics, or Physics are eligible, providing certain undergraduate requirements are satisfied.

Students must comply with the rules and regulations as outlined in General Requirements for graduate work in the College of Engineering.

A student is admitted to candidacy for the Master of Science in Engineering degree only by formal written application after he has completed at least 12 credit hours of graduate work at West Virginia University with a grade-point average of at least 3.0.

Candidates with no training in Forestry will be required to take courses in the Division of Forestry.

Candidates may elect one of three areas for specialization:

1. *Hydrology.* Course requirements include: Ag. Eng. 240, C.E. 221, 252, Geol. 261, 263, Statistics 211 and 212. Electives will be selected to take into account the student's background and interests.

2. *Power and Machinery.* Course requirements include: Statistics 211 and 212, Forest Eng. 391, 392. Electives will be selected to take into account the student's background and interests.

3. *Industrial.* Course requirements include: Statistics 211 and 212. Electives will be selected to take into account the student's background and interests.

Thesis Supervisor. Each student will be assigned a thesis supervisor who will serve as chairman of his thesis committee.

Thesis. A thesis is normally required of all candidates for the Master of Science in Engineering Degree. In most cases it will be necessary to take 6 hours of research, Forest Eng. 397. A thesis, however, is not automatically approved after the required number of semester hours of research work have been completed. The candidate may find that completion of the thesis for approval will delay his originally anticipated date of graduation. The major subject, including thesis, must be taken in Forest Engineering. Upon satisfactory completion of his thesis and course work, the candidate will be given an examination by his special committee.

Forest Engineering

- 300. **Seminar.** I or II. 1 hr. Current discussion of research in forest engineering and special report.
- 320. **Advanced Independent Study.** I, II, S. 1-6 hr.
- 391. **Logging Systems Engineering.** I. 3 hr. PR: Math. 140 or consent. Theory and design of modern forest harvesting systems such as balloon logging, cableways, pipelines and conveyors. Design features of specialized forest harvesting machines and devices. Systems engineering approach to equipment utilization. 3 rec.
- 392. **Hydraulic Power.** II. 3 hr. PR: Math. 140 or consent. Includes characteristics of hydraulic control components, hydraulic fluid characteristics, materials in hydraulic circuits, components and elements for circuit design, the feedback control approach, derivation of component transfer functions, measuring control dynamic characteristics, computer simulation techniques, hydraulic control circuits and hydraulic design practice. 3 rec.
- 397. **Research.** I, II, S. 1-15 hr. Advanced research or special investigations on some topic related to forest engineering.

CHEMICAL ENGINEERING

Master of Science in Chemical Engineering

Master of Science in Engineering

Master of Science in Nuclear Engineering

Students must comply with rules and regulations as outlined in general requirements for graduate work in the College of Engineering. The three types of master's degree program as outlined under College of Engineering Curricula are offered in all graduate programs administered by the Department of Chemical Engineering.

Adviser and Examining Committee. Each student will be assigned an adviser and an advisory and examining committee.

Examination. A candidate shall be required to pass examinations which may be written, or oral, or both, covering both course material and the thesis or problem report, depending upon the program selected.

Master of Science in Chemical Engineering

A. F. Galli, *Program Director*

The M.S.Ch.E. program is professionally oriented, specifically designed for those wishing to pursue the active practice of chemical engineering. Admission is restricted to those holding a baccalaureate degree in chemical engineering or equivalent.

Courses. All students pursuing a master's program are required to complete Ch.E. 344 and 345, two advanced unit operations courses selected from Ch.E. 302, 304, 306, and 307, and Ch.E. 341, or its equivalent, and such additional courses as may be required by his committee.

Practice Oriented Program. The department offers a unique practice-oriented program, for students desiring to pursue the active practice of chemical engineering. This 36-hour non-thesis program requires the completion of the courses specified above but including all four unit operations as well as Ch.E. 383, a minimum of four hours of Ch.E. 310-311, and either the process development sequence, Ch.E. 323-324, or the design sequence, Ch.E. 372-373.

Industrial Practice. Candidates for the practice oriented program must show evidence of industrial employment during two summers, usually that immediately preceding admission to the program and that following the first year, unless such employment is otherwise precluded.

Final Examination. The final examination for those pursuing the practice-oriented program will consist of the solution of a comprehensive problem of professional character, administered by an examining board appointed by the program director, followed by an oral defense of the solution before the examining board, which will evaluate the solution according to professional standards.

Master of Science in Engineering

R. C. Bailie, *Program Director*

The M.S.E. Program is available to students holding a baccalaureate degree in chemical engineering who wish to pursue a broad interdisciplinary program, and to students holding a baccalaureate degree in other fields of engineering or the physical sciences.

Courses. All students pursuing a master's program are required to complete Ch.E. 344 and 345, two advanced unit operations courses selected from Ch.E. 302, 304, 306, and 307, and Ch.E. 341 or its equivalent and such additional courses as may be required by his committee.

Materials Science Engineering and Nuclear Engineering

G. L. Blackshaw, *Program Director*

The Department of Chemical Engineering offers graduate programs in Materials Science Engineering and Nuclear Engineering leading to the degrees of Master of Science in Engineering and Master of Science in Nuclear Engineering. Admission may be granted to those holding baccalaureate degrees in engineering, pure and applied physical science, or mathematics. Applicants must present entrance credits consisting of an acceptable background in mathematics and physical science including Modern Physics.

Areas of emphasis in Materials Science Engineering are studies of the fundamental physical properties and process engineering of ceramics, metals, and polymers, while those in Nuclear Engineering include reactor engineering, process radiation, and the behavior of materials in nuclear radiation environments.

Courses. Required courses in Materials Science Engineering are Mat.E. 356-357, Mat.E. 358-359. Required courses in Nuclear Engineering include Nuc.E. 390, 391, 392, and 393. The Nuclear Engineering curriculum is approved for participation in the Atomic Energy Commission Special Fellowship Program in Nuclear Science and Engineering.

Students enrolled in either program will select additional courses in engineering, physical science and mathematics pertinent to materials science engineering and nuclear engineering technology. The development of a Materials Science Engineering minor area of study by Nuclear Engineering majors and vice versa will be particularly encouraged as a group selection of elective courses.

The Degree of Doctor of Philosophy

H. P. Simons, *Program Director*

A candidate for the degree of Doctor of Philosophy must comply with the rules and regulations as outlined in general requirements for graduate work in the College of Engineering. A program with a major in Chemical Engineering, Materials Science Engineering, or Nuclear Engineering, designed to meet the needs and objectives of each student, will be developed in consultation with the student's committee.

The research work for a doctoral dissertation should show a high order of originality on the part of the student and must offer an original contribution to the field of engineering science. It must have good literary form and style, and must give a thorough survey of the prior art with acceptable standards of documentation. Upon completion of the dissertation, the candidate will be required to submit to an oral defense. This examination will be designed to establish the candidate's logic, critical ability, and reasoning power, and will be based upon the field covered by the dissertation.

Chemical Engineering

201. **Chemical Engineering Fundamentals.** 3 hr. PR: T.A.M. 101, T.A.M. 104, Math. 140. Review of vector and tensor algebra; viscosity; method of shell balances; equations of continuity, motion, and energy; Navier-Stokes equation; turbulent flow; flow through porous media; microscopic momentum balances; boundary layer; heat conduction in solids; convective heat transfer; boiling and condensation; radiation; diffusion of mass; film and penetration theory; analogies among heat, mass, and momentum transfer. 3 hr. rec.
202. **Chemical Engineering Fundamentals.** 3 hr. Continuation of Ch.E. 201. 3 hr. rec.
210. **Process Engineering.** 3 hr. PR: Ch.E. 202 or consent. Process equipment calculations for unsteady state. Determination of maximum and minimum process conditions. Economics of processing methods. 3 hr. rec.
224. **Process Development.** 3 hr. PR: Chem. 134 and 144, Ch.E. 202 and 243. Development of process systems from the unit operations-unit process concept. Use of thermodynamics and kinetics in the evaluation of system requirements and performance. 3 hr. rec.
242. **Chemical Engineering Thermodynamics and Kinetics.** 3 hr. PR: Chem. 144. Material and energy balances; internal energy levels; statistical distributions and statistical evaluation of thermodynamic functions; empirical evaluation of thermodynamic functions; second law of thermodynamics; thermodynamic properties of solutions and solid phases; chemical and physical equilibria. Kinetics of simple and complex chemical reactions; development of rate equations. Kinetics of vapor phase-catalytic reactions; development of rate equations and mechanisms of reactions; back mixing. 3 hr. rec.
243. **Chemical Engineering Thermodynamics and Kinetics.** 3 hr. Continuation of Ch.E. 242. 3 hr. rec.
- 270, 271. **Chemical Engineering Professional Block.** 9 hr. each. PR: Completion of all technical courses prescribed for the first three years. Professional aspects of chemical engineering involving analysis, synthesis and design, process dynamics, design of experiments, materials engineering, design and computation laboratories, and seminar on engineering practice and ethics. Includes a comprehensive plant design project. Thirty-five hours per week divided between lecture, recitation, computation and experimental laboratory. The Engineer-in-Training examination is required.

280. **Chemical Engineering Problems.** 1-6 hr. For junior, senior, and graduate students. May be used to correct deficiencies preparatory to or following courses such as Ch.E. 270 and 271 or for students in other disciplines desiring to take only a portion of a course.
300. **Chemical Engineering Seminar.** 1-6 hr. Includes such topics as statistical and non-equilibrium thermodynamics, physico-chemical hydrodynamics, optimization, rheology, heterogeneous reactors, and fast-reaction kinetics. Other topics may be included consistent with demand and changing requirements.
302. **Advanced Heat Transfer.** 2-5 hr. PR: Math. 140 and consent. Theory of steady and transient conduction, radiation heat transfer, dimensional analysis and analogy, natural convection, forced convection, heating and cooling inside and outside tubes, finned tubes and compact heat exchangers, packed and fluidized system heat transfer, heat transfer in condensing vapor, heat transfer in boiling liquids and evaporation, high velocity flow heat transmission, application to process heat transfer and design. 3 hr. rec., 0-6 hr. lab.
304. **Advanced Mass Transfer.** 2-5 hr. PR: Math. 140 and consent. Theory of diffusion, interphase mass transfer theory, simultaneous mass and heat transfer, principles of design, equipment survey, mechanical operations, mass transfer performance, scale-up practices, mass transfer in solid-gas and solid-solid phases, liquid-liquid extraction. 3 hr. rec., 0-6 hr. lab.
306. **Advanced Fluid Dynamics.** 2-5 hr. PR: Math. 140 and consent. Vector and tensor analysis, differential equations of fluid flow, flow of nonviscous fluid, laminar flow, turbulent flow, analogy between fluid momentum, mass and heat transfer, dimensional analysis, the laminar sublayer, flow of fluid past immersed bodies, fluid dynamics of particle suspensions, flow of fluids through porous media, non-Newtonian fluid flow. 3 hr. rec., 0-6 hr. lab.
307. **Advanced Distillation.** 2-5 hr. PR: Math. 140 and consent. Advanced study of vaporization principles of separation of liquid mixtures, steam, batch, continuous, azeotropic, extractive, and molecular distillation. 3 hr. rec., 0-6 hr. lab.
- 310, 311. **Advanced Chemical Engineering Laboratory.** 2-4 hr. each. PR: Consent. Design, construction, operation and supervision of specialized equipment for obtaining engineering data. Design of engineering experiments, data processing, and reporting including evaluation of performance.
- 323, 324. **Advanced Process Development.** 3 hr. PR: Consent. Use of extended and generalized unit process and unit operation concepts; specialized synthetic methods; reaction mechanisms and their effects on equipment design and performance; study of properties, their evaluation, prediction and marketability; industrial toxicology and plant safety. 3 hr. rec.
341. **Mathematical Methods in Chemical Engineering.** 3 hr. PR: Math. 140. Emphasis is placed upon the formulation of the differential and difference equations, both ordinary and partial, governing chemical engineering operations. Analytic and numerical techniques used for their solutions include transform methods. 3 hr. rec.
344. **Advanced Chemical Engineering Thermodynamics.** 3 hr. PR: Consent. Review of thermodynamic transformations; advanced applications to chemical and physical equilibria; development and applications of phase rule; equilibria diagrams for nonideal systems; determination and use of activity coefficients; methods of estimating thermodynamic functions; introduction to statistical mechanics. 3 hr. rec.
345. **Advanced Chemical Engineering Kinetics.** 3 hr. PR: Consent. Applications of chemical kinetics to industrial reactor design; review of physico-chemical principles; theories of reactions; design of batch and flow reactors; theories of catalysis; reactor mechanisms; data interpretation; applications to design of catalytic reactors, effects of diffusion on catalytic reactions. 3 hr. rec.

- 372, 373. **Advanced Chemical Engineering Design.** 3 hr. each. PR: Consent. Critical analysis and evaluation of equipment design procedures. Advanced aspects of plant layout with particular emphasis upon the systems approach. 3 hr. rec.
380. **Advanced Independent Study.** 1-6 hr. PR: Consent. Designed to increase the depth of study in a specialized area of chemical engineering.
383. **Advanced Systems Engineering.** 3 hr. PR: Consent. Control systems and the feed-back concept, transfer functions and mathematical analysis of dynamic equations, transient analysis and stability of control systems, frequency response of control systems, thermal process dynamics, mass transfer dynamics, chemical process dynamics, use of analog computer for study of system behavior, nonlinear systems and adaptive control, random response and filtering of noise. 3 hr. rec.
397. **Research.** 1-15 hr. Suitable problem in chemical engineering.

Nuclear Engineering

290. **Introductory Nuclear Engineering.** 3 hr. PR: Physics 124. Includes elementary nuclear physics necessary for understanding nuclear engineering. Design and operation of nuclear reactors, shielding, instrumentation, health physics, fuel cycles, uses of radioactive isotopes, nuclear propulsion. 3 hr. rec.
300. **Nuclear Engineering Seminar.** 1-6 hr. PR: Consent. Includes such topics as the kinetics of boiling water reactors, breeder reactor concepts, fast reactor systems, pulsed reactor systems, radiation chemistry, and space nuclear power systems. Other topics may be included consistent with demand and changing requirements.
380. **Advanced Independent Study.** 1-3 hr. Special studies in fuel processing, shielding, reactor technology, and related areas.
390. **Analysis of Nuclear Energy Systems.** 3 hr. PR or conc: Physics 225 or equiv., and Physics 287 or equiv. Probability concepts and nuclear cross sections. Multiplication constant and neutron flux. Diffusion theory. Homogeneous reactors: one group theory; multigroup theory. Heterogeneous reactors. Reflected reactors. Reactor kinetics. Control rod theory. Special considerations in analysis of heterogeneous systems. 3 hr. rec.
391. **Principles of Nuclear Reactor Engineering.** 3 hr. PR: Nuc.E. 390. Thermal analysis of reactor systems. Shielding. Fuel element design. Reactor poisons. Instrumentation. Economics of nuclear systems. Radiation, protection. Legal aspects. Radioactive waste disposal. 3 hr. rec.
392. **Interaction of Radiation and Matter.** 3 hr. PR or conc: Physics 225. Radiation damage models, effects of nuclear radiations on reactor components and other materials, experimental techniques. Industrial applications: process control, polymerization, sterilization, pasteurization. 3 hr. rec.
393. **Nuclear Laboratory.** 1-6 hr. PR or conc: Nuc.E. 390 or equiv. Techniques of radiation measurements. Determination of neutron properties; diffusion length, albedo, etc. Exponential reactor parameters. Reactor simulation. Experiments with swimming pool reactor and cobalt-60 radiation facility.
397. **Research.** 1-15 hr.

CIVIL ENGINEERING

Master of Science in Civil Engineering

Students must comply with rules and regulations as outlined in general requirements for graduate work in the College of Engineering.

Courses. No rigid curriculum is prescribed for the degree of Master of Science in Civil Engineering. Graduate level work in mathematics and mechanics is customary

and at least 15 hours should be selected from civil engineering courses numbered 300 or above.

Thesis. A thesis is normally required of candidates for the M.S.C.E. degree. A maximum of 6 semester hours credit in research (C.E. 397) is usually devoted to thesis preparation. However, the thesis is not automatically approved after the required number of semester hours of research work have been completed. The thesis must conform with the general requirements of the Graduate School and with any additional requirements established by the Department of Civil Engineering.

At the discretion of the student's advisory committee a non-thesis program may be established in which either a comprehensive problem or additional course work is substituted for the thesis.

Final Examination. The candidate for the M.S.C.E. degree shall be given an oral or written examination by his advisory and examining committee. The examination shall cover all course material and the thesis, if one is required.

The Degree of Doctor of Philosophy

A candidate for the degree of Doctor of Philosophy must comply with the rules and regulations as outlined in general requirements for graduate work in the College of Engineering. A program designed to meet the needs and objectives of each student will be developed in consultation with the student's committee.

The research work for the doctoral dissertation must show a high degree of originality on the part of the student and must constitute an original contribution to the art and science of civil engineering. The dissertation must have good literary form and style and must present a thorough review of the prior study in the subject with acceptable standards of documentation. The candidate is required to take a final oral examination upon completion of the dissertation. This examination is designed to permit the candidate to demonstrate his ability to present and defend his work orally in a logical manner.

Civil Engineering

210. **Photogrammetry.** 3 hr. PR: C.E. 102. Geometry and interpretation of the aerial photograph; flight planning; radial-line control; principles of stereoscopy; plotting instruments. 2 hr. rec., 3 hr. lab.
211. **Geodesy.** 3 hr. PR: C.E. 102 and Math. 16. Precise base line measurements, triangulation and leveling, geodetic astronomy; figure of the earth, map projections; rectangular coordinate systems; least squares adjustment; gravity. 3 hr. rec.
222. **Open Channel Flow.** 3 hr. PR: C.E. 115. An analysis of the hydraulic problems associated with natural waterways, man-made waterways, and the design of the hydraulic structures of open channels. 3 hr. rec.
231. **Concrete and Aggregates.** 3 hr. PR: C.E. 131, T.A.M. 103. Considerations and methods for the design of concrete mixes. Effect of air entraining agents and other additives. Studies of the influence of aggregate properties on the design and performance of concrete mixtures. An analysis of the methods of test commonly used for concrete and aggregates and the significance of these tests. 2 hr. rec., 3 hr. lab.
232. **Principles of Transportation Engineering.** 3 hr. PR: C.E. 131 or consent. A basic approach to the problem of integrated transportation systems from the standpoint of assembly, haul, and distribution means. Analysis of the characteristics of the transport equipment and traveled way. Power requirements, speed, stopping, capacity, costs, economics of location and route selection will be discussed. Future technological developments and innovations will be considered. 3 hr. rec.
233. **Construction Methods.** 3 hr. PR: C.E. 131 or equiv. The study of construction methods, equipment, and administration with particular emphasis on the influence of new developments in technology. 2 hr. rec., 3 hr. lab.

234. **Introduction to Traffic Engineering.** 3 hr. PR: C.E. 131. This course will provide instruction in the purpose, scope, and methods of traffic engineering. Emphasis will be placed upon the three basic elements of the transportation system, i.e. the human, the vehicle, and the roadway. The characteristics of each element and interactions between the elements will be studied. The laboratory will be devoted to conducting simple traffic studies, solving practical problems, and designing traffic facilities. 2 hr. rec., 3 hr. lab.
251. **Public Health Engineering.** 3 hr. PR: C.E. 146 or 147 or consent. The engineering aspects involved in the control of the environment for the protection of the health and the promotion of the comfort of man. Discussions will include communicable disease control, milk and food sanitation, air pollution, refuse disposal, industrial hygiene, and radiological health hazards. 3 hr. rec.
252. **Water Resources Engineering.** 3 hr. PR: C.E. 115. The design of water-resource systems. The interrelationship between economic objectives, engineering analysis, and governmental agencies. 3 hr. rec.
260. **Structural Analysis II.** 3 hr. PR: C.E. 160. An introduction to the fundamental theory of statically indeterminate structures. General theory of continuity and iterative and energy methods applied to the analysis of indeterminate beams and frames. 3 hr. rec.
261. **Statically Indeterminate Structures.** 3 hr. PR: C.E. 260. Advanced topics in indeterminate structural analysis for trusses and nonprismatic members. 3 hr. rec.
270. **Structural Design I.** 3 hr. PR or conc: C.E. 260. Theory and design of reinforced concrete members. Design considerations for concrete bridges and buildings. 2 hr. rec., 3 hr. lab.
271. **Structural Design II.** 3 hr. PR or conc: C.E. 260. Design of steel bridge and building structures. Welded, riveted, and bolted connections; simple and moment-resistant connections; cost estimates. 2 hr. rec., 3 hr. lab.
272. **Plastic Design of Steel Structures.** 3 hr. PR: C.E. 260, 271 or consent. The fundamental concepts of the plasticity of steel. Analysis of structures for ultimate load. The influence of axial forces, shear forces, and local buckling on the plastic moment. Study of structural connections and deflections. Steel structure design. 3 hr. rec.
273. **Prestressed Concrete.** 3 hr. PR: C.E. 270. The analysis and design of determinate and indeterminate prestressed beams and frames. 3 hr. rec.
274. **Timber Design.** 3 hr. PR: C.E. 160 and Forestry 232. Emphasis on the fundamentals of modern timber design and analysis. Topics to be presented include a review of wood properties, the design of beams, columns, arches, trusses, and pole structures using dimensional lumber, glue-laminated and plywood components. Detailed study of connections using nails, shear connectors, and adhesives. 3 hr. rec.
275. **Reinforced Concrete.** 3 hr. PR: C.E. 160, 270. Theory and design of slabs, beams, columns, footings, retaining walls, and concrete buildings, with emphasis on ultimate load design. 2 hr. rec., 3 hr. lab.
280. **Soil Mechanics.** 3 hr. PR: C.E. 115, T.A.M. 101. Origins and distribution of soils, classification of soils, fundamental soil properties and stresses in soils. Subsurface exploration. Introduction to foundations design and the design and construction of earth structures. 2 hr. rec., 3 hr. lab.
281. **Foundations Engineering.** 3 hr. PR: C.E. 131, 280. Soils exploration and the design and analysis of engineering foundations. Particular emphasis on earth pressures and the design of retaining walls, studies of bracing systems and the elements of shallow and deep foundations for bridges and buildings. Movement of water through soil structures and control of water in excavations. 3 hr. rec.

290. **Civil Engineering Problems.** 1-4 hr. For junior, senior, and graduate students.
301. **Geotechnic.** 3 hr. PR: Consent. A presentation of a unified approach to the various aspects of soil formation and the influence of the formative factors on the nature of soils and their use as engineering materials. Presented cooperatively with the Department of Agronomy and the Department of Geology. 3 hr. rec.
302. **Traffic Flow Theory.** 3 hr. PR: I.E. 244 and C.E. 339 or consent. An introduction to the basic concepts of quantitative analysis of traffic systems. Topics include probability theory, queuing theory, pedestrian and traffic delay at traffic signals, turning at intersections, parking problems, merging traffic on two lane roads, simulation of traffic problems. 3 hr. rec. (Also listed as I.E. 302.)
321. **Hydraulic Structures.** 3 hr. PR: C.E. 221 or consent. The hydraulic analysis and design of engineering structures such as reservoirs, dams, spillways, gates, and outlet works. The study of hydraulic machinery, irrigation, hydroelectric power, drainage and flood control. 3 hr. rec.
330. **Bituminous Materials and Mixtures.** 3 hr. PR: C.E. 131. Manufacture and testing of bituminous materials. Significance of tests and specifications of bituminous materials. Principles of the design of bituminous mixtures, including methods of test and the influence of aggregate, temperature, and other variables upon design for stability and durability. Production of bituminous mixtures and construction practice in utilizing these mixtures. 2 hr. rec., 3 hr. lab.
331. **Pavement Design.** 3 hr. PR: C.E. 131, 280. Effects of traffic, soil, and loads on the design of pavement. Consideration of drainage and climate. Design of bases and sub-bases. Methods of design of flexible and rigid pavements. Performance of pavement surveys. 2 hr. rec., 3 hr. lab.
332. **Highway Economics and Administration.** 3 hr. PR: Consent. Study of the methods of financing highways, including federal participation. Consideration of the means of establishing allocation of highway cost and determination of economic justification of routes. Analysis of highway administrative organizations. 3 hr. rec.
333. **Geometric Design of Highways.** 3 hr. PR: Consent. The theory and practice of the geometric design of modern highways. Horizontal and vertical alignment, cross-slope, design speed, sight distances, interchanges, and intersections are discussed. Critical analysis of design specifications. 2 hr. rec., 3 hr. lab.
334. **Urban Problems.** 3 hr. PR: Consent. The study of the particular problems of transportation in the urban area as they relate to the general development of the city. Emphasis is on the role of the engineer in the planning for urban transportation and the relationship of the engineer to the city planner and to the city administration. 3 hr. rec.
335. **Surface and Subsurface Drainage.** 3 hr. PR: Consent. The study of the nature and requirements of drainage studies and drainage design as they pertain to transportation facilities. Emphasis is on the theory of drainage design and a critical analysis of drainage practices. 3 hr. rec.
336. **Highway Planning I.** 3 hr. PR: Consent. Analysis of planning programs and methods including highway needs studies, priority rating systems, and programming methods. Consideration of traffic assignment and forecasting techniques. Devoted primarily to rural route problems. Case history method of study utilized. 3 hr. rec.
337. **Highway Planning II.** 3 hr. PR: C.E. 336. Continuation of C.E. 336 with special attention to urban locations and planning. 3 hr. rec.

338. **Highway Laws.** 3 hr. PR: Consent. The analysis of existing highway laws with emphasis on those aspects particularly related to planning functions such as reservation of right-of-way, access control, eminent domain, systems classification, and the basis for the existence and operation of various planning agencies. 3 hr. rec.
339. **Traffic Engineering Characteristics.** 3 hr. PR: C.E. 131 or consent. The analysis of the basic characteristics of drivers, vehicles, and roadway that affect the performance of road systems. Studies of volumes, speeds, delays, intersections, interchanges, capacity, and accidents will be considered. The techniques of traffic engineering measurements, investigations, and data analysis, including laboratory practice, will be included. 2 hr. rec., 3 hr. lab.
340. **Traffic Engineering Operations.** 3 hr. PR: C.E. 339. The theory and practice of the application of traffic engineering regulations, traffic flow theory, the design and use of traffic control devices and signal systems. Traffic administration and parking control will be discussed. 3 hr. lec.
345. **Properties of Air Pollutants.** 3 hr. PR: Consent. Physical, chemical, biological, and social behavioral properties of dusts, droplets, and gases in the atmosphere. Air pollutant sampling and analysis. The planning and operation of air pollution surveys. 2 hr. rec., 3 hr. lab.
346. **Air Pollution Control Engineering.** 3 hr. PR: C.E. 345 or consent. Study of the engineering alternatives in achieving various degrees of air pollution control. Factors that are considered in selection and specification of dust and gas collectors and converters for various types of operations, and the use of alternate process methods and process materials. 2 hr. rec., 3 hr. lab.
347. **Air Pollution Control Standards.** 3 hr. PR: C.E. 346 or consent. Comparative study of technical, economical, and social factors used in developing and establishing air pollution standards, criteria, and control limitations. Relationships between process design specifications, pollutant emission limitations, ambient air pollution effects on people and objects, air quality standards and emission performance limitations. 2 hr. rec., 3 hr. lab.
348. **Air Pollution Control Programs.** 3 hr. PR: C.E. 346 or consent. Examination of air pollution control programs of industries and government. Rationales and patterns of organization structure and operating administrative factors, including intra-office and inter-office and other group relationships. Significance of relationship with planning fire prevention, water pollution control, building inspection, and economic development agencies. 3 hr. rec.
349. **Solid Waste Disposal.** 3 hr. PR: Consent. Study of traditional patterns and problems of solid waste storage, transport, and disposal. Examination of various engineering alternatives with appropriate consideration for air pollution control, water pollution control, and land reclamation. Analytical approaches to recovery and reuse of materials. 2 hr. rec., 3 hr. lab.
350. **Sanitary Chemistry and Biology.** 3 hr. PR: C.E. 147 or consent. Study of the physical and chemical properties of water. Theory and methods of chemical analysis of water, sewage, and industrial wastes. Biological aspects of stream pollution problems. 2 hr. rec., 3 hr. lab.
352. **Water Treatment Theory.** 3 hr. PR: C.E. 350. Theory of the various procedures and techniques utilized in the treatment of water for municipal and industrial use. Review of water quality criteria. Design of water purification facilities. 2 hr. rec., 3 hr. lab.
353. **Sewage and Industrial Waste Treatment.** 3 hr. PR: C.E. 350. Theory and methods of sewage treatment. Chemical, biochemical, and physical factors related to waste treatment. Characteristics of industrial wastes and special considerations necessary for their disposal. 2 hr. rec., 3 hr. lab.

354. **Industrial and Advanced Waste Treatment.** 3 hr. PR or conc: C.E. 350 or consent. An introduction to the basic physical and chemical operations used in industrial and advanced waste treatment; applications for wastewater reclamation and reuse; study of industrial wastes from the standpoint of process, source, and treatment. 3 hr. rec.
- 355. **Municipal and Industrial Design of Solid Wastes Disposal Operations.** 3 hr. PR: C.E. 354 or consent. Study of design criteria of existing methods and equipment for the disposal of solid wastes generated by industry and municipalities; on site preparation; volume and density modification; and reclamation of marketable materials. Process, source, treatment, and final disposal with considerations of waste reclamation and reuse of available energy. 3 hr. rec.
357. **Hydraulics of Sanitary Engineering Works.** 3 hr. PR: C.E. 221. The application of the techniques of population growth estimation, rainfall and runoff analysis, food flow, and ground water data to the design of sanitary works. Design of water distribution systems and sewerage systems. 2 hr. rec., 3 hr. lab.
358. **Design of Sanitary Works.** 3 hr. PR: C.E. 221. The investigation of water supply and waste water disposal problems. The design of waste water treatment facilities. 2 hr. rec., 3 hr. lab.
- 359. **Basic Radiological Health.** 3 hr. PR: Consent. Fundamental theory and terminology. Environmental and occupational hazards in the nuclear field. Radioactive waste disposal. Laboratory measurements of radioactivity. 2 hr. rec., 3 hr. lab.
360. **Statically Indeterminate Structures.** 3 hr. PR: C.E. 260 or consent. General theory of continuity, iterative, and classical methods of analysis of skeletal structures with emphasis on the influence coefficient method. 3 hr. rec.
361. **Bridge Engineering.** 3 hr. PR: C.E. 360. Statically indeterminate trusses; continuous trusses; steel and concrete arches; long-span and suspension bridges; secondary stresses. 3 hr. rec.
362. **Numerical Methods of Structural Analysis.** 3 hr. PR: C.E. 261 or 360. Methods of successive approximations and numerical procedures for the solution of structural problems. Application of these procedures to the analysis of bridges and builders. 3 hr. rec.
363. **Introduction to Structural Dynamics.** 3 hr. PR: Math. 140 and C.E. 261 or 360. General theory for dynamic response of systems having one or several degrees of freedom. Emphasis on the application of dynamic response theory to structural design. 3 hr. rec.
373. **Structural Design for Dynamic Loads.** 3 hr. PR: C.E. 363 or consent. Nature of dynamic loading caused by earthquakes and nuclear weapon blasts; nature of dynamic resistance of structural elements and structural systems; criteria for the design of blast-resistant structures; criteria for the design of earthquake-resistant structures; simplified and approximate design methods. 3 hr. rec.
374. **Behavior and Advanced Design of Timber Structures.** 3 hr. PR: C.E. 260, C.E. 274, Forestry 232 or consent. A study of the behavior and analysis of structural systems and components fabricated from timber. Topics to include the behavior of timber members subjected to bending, shear, and compression, impact, and vibration. An evaluation of the time dependent characteristics of timber members under load. The analysis and design of special timber structures including lamella roofs, stressed skin and prestressed members, and space frames. 3 hr. rec.
375. **Analysis and Design of Multistory Structures.** 3-6 hr. PR: C.E. 270. Theories of action of beams, slabs, and columns of reinforced concrete; review of standard codes and specifications and their influence on design. 3 hr. rec.

376. **Behavior of Reinforced Concrete Members.** 3 hr. PR: C.E. 270 or consent. Studies of the actual behavior and strength of reinforced concrete members by critically reviewing experimental and analytical investigations. Beams subjected to pure flexure; columns subjected to axial compression; combined flexure and compression; combined flexure, shear, and bond. 3 hr. rec.
377. **Behavior of Reinforced Concrete Structures.** 3 hr. PR: C.E. 376. Continuation of C.E. 376. Studies of behavior and strength of statically indeterminate reinforced concrete structures. Comparison with reinforced concrete codes and specifications. 3 hr. rec.
378. **Thin Shell Roof Structures I.** 3 hr. PR: Math. 140, C.E. 261 or consent. Emphasis on the development and solution of the fundamental elastic equations for barrel vault roofs using matrix algebra. Study of the effects of edge members upon the strength and stiffness of barrel vault roofs. Design of simple shell structures. 3 hr. rec.
379. **Thin Shell Roof Structures II.** 3 hr. PR: C.E. 378 or consent. A continuation of C.E. 378. Analysis of multiple cylindrical shells using the theory of elasticity and matrix algebra. Ultimate load and variational methods in shell analysis. Design and analysis of doubly curved shells. 3 hr. rec.
380. **Soil Properties and Behavior.** 3 hr. PR: Consent. A study of soil mineralogy and the physico-chemical properties of soils and their application to an understanding of the behavior of soils. Included is a detailed review of the basic and classical theories of permeability, consolidation, shear strength, and compaction. The prediction of the engineering behavior of soils is viewed in light of physico-chemical concepts. 3 hr. rec.
381. **Soil Testing.** 3 hr. PR: C.E. 280 or consent. Designed to complement and expand the material covered in C.E. 380 from an experimental standpoint. Experimental studies will be conducted to demonstrate empirical and theoretical principles. Emphasis will be placed on the proper interpretation of experimental results and the application of such results to practical problems. 1 hr. rec., 6 hr. lab.
382. **Foundations Engineering.** 3 hr. PR: C.E. 380 or consent. Application of the principles of theoretical soil mechanics to the design of shallow and deep foundations. Detailed attention is given to methods of sub-surface exploration, spread footings and mats, pile foundations, retaining walls, sheet pile structures and braced cofferdams. Particular emphasis is given to economy and performance in the selection of foundation treatment. 3 hr. rec.
383. **Earthwork Design.** 3 hr. PR: C.E. 380 or consent. Application of the principles of theoretical soil mechanics to the design of embankments of earth and rock. Detailed attention is given to compaction methods and equipment, the stability of natural and man-made slopes, embankment foundation stability and the design of earth and rockfill dams. 3 hr. rec.
384. **Groundwater and Seepage.** 3 hr. PR: Consent. The flow of ground-water through soils and its application to the design of highways and dams and to construction operations. Particular emphasis is placed on the analytical solution of seepage problems. The classical flow net techniques for solving seepage problems are also given detailed consideration. 3 hr. rec.
385. **Airphoto Interpretation.** 3 hr. PR: Graduate standing. A study of airphoto interpretation techniques to obtain qualitative information concerning the extent, type, and engineering characteristics of surficial materials. Emphasis will be placed on the use of airphoto interpretation for the location of construction materials and the evaluation of engineering problems associated with the different materials that are encountered in the design and location of engineering facilities.

386. **Soil Dynamics.** 3 hr. PR: C.E. 380 and consent. The fundamental behavior of soils subjected to dynamic loads produced by explosion effects, earthquake effects, and foundation vibrations. Particular emphasis is placed on the stress-strain-time behavior of soils for conditions of rapid stress or strain change. Consideration is given to wave propagation resulting from ground motions. The theories of vibration of a mass resting on an elastic half-space are applied to foundations vibration problems. 3 hr. rec.
390. **Advanced Design Problems.** 2-6 hr. A design or investigation of any assigned problem related to civil engineering.
395. **Seminar.** 1-2 hr. PR: Consent. Studies and group discussion of structural, fluid mechanics, surveying, transportation, soil mechanics and foundations, and sanitary problems.
397. **Research.** 1-15 hr. per sem. Original report or investigation on some topic in the civil engineering field.

ELECTRICAL ENGINEERING

Master of Science in Electrical Engineering

Students must comply with rules and regulations as outlined in general requirements for graduate work in the College of Engineering.

Qualifying Examination. A qualifying examination is required of all advanced degree candidates enrolled in electrical engineering.

Thesis. Normally a thesis is required of all candidates for the degree of Master of Science in Electrical Engineering. Approval by the Advisory and Examining Committee is necessary before the thesis will be accepted. The thesis must be presented in a form that conforms to general requirements of the Graduate School, and in addition should conform to additional thesis requirements of the department.

Whether or not a thesis is required shall be determined by the department and shall be recorded in the student's file as a part of his planned program.

Final Examination. Each candidate for the Master's degree shall pass a final examination administered by his Advisory and Examining Committee. This examination may be written or oral or both and shall cover the course material. If a thesis has been required, the examination shall also cover the thesis.

Courses. The following grouping of courses is a guide for selecting a graduate program leading to the degree of Master of Science in Electrical Engineering.

Group	<i>I. Required of all candidates</i>	<i>Hr.</i>
	E.E. 300. Seminar (Audit)	0
	E.E. 325. Advanced Linear Circuit Analysis	3
Group II.	<i>Major (Minimum of 9 hours of engineering courses in the 300 series other than Group I)</i>	
Group III.	<i>Minor (6 hours)</i>	
	Approved courses in Mathematics, Physics, or Statistics.	

In order to meet the minimum requirements for the degree of Master of Science in Electrical Engineering additional courses may be taken from the following, subject to the approval of the student's Advisory and Examining Committee:

1. Courses in the 200 series which are not required for the degree of Bachelor of Science in Electrical Engineering at West Virginia University.
2. West Virginia University courses in the 300 series.

Students with a B.S.E.E. degree from other institutions may be required to take some electrical engineering courses in the 200 series as prerequisites for graduate courses. If these courses are normally required for the B.S.E.E. at West Virginia University, they will not be accepted for credit in a Master's Degree program without approval of the student's Advisory and Examining Committee.

The Degree of Doctor of Philosophy

A candidate for the degree of Doctor of Philosophy must comply with all requirements of the Graduate School and with the rules and regulations as outlined in "A Guide to the Graduate Program in Engineering" for graduate work in the College of Engineering. A program designed to meet the needs and objectives of each student will be developed in consultation with the student's committee. In addition, the following will be required by the department:

1. In general, requirements for the M.S.E.E. degree must be fulfilled. These requirements are outlined above.
2. Candidates for the Ph.D. degree who have been admitted with an M.S. degree from other institutions must satisfy the departmental course requirements for the M.S.E.E. degree.
3. A Ph.D. degree candidate will normally be required to take a minimum of six hours in his minor field. A minimum of three of these hours must be at the 300 level.

Electrical Engineering

200. **Seminar.** (Credit). PR: Senior standing. Special material and projects.
205. **Electrical Fundamentals.** 4 hr. PR: E.E. 105. Fundamentals and operating characteristics of electrical machines and transformers. Electron tube, phototube, and transistor characteristics. Electronic circuits. (Not open to electrical engineering students.) 3 hr. rec., 3 hr. lab.
210. **Electronics for Scientists.** 3 hr. PR: General Physics and Calculus or consent. A special course for chemists, physicists, medical researchers and other research workers having a limited background in electronics. The material covered will begin with electrical and electronic fundamentals and leads systematically into servomechanisms, operational amplifiers, digital circuits, and other devices used in current laboratory research and control problems. (Not open to Engineering students.) 1 hr. rec., 6 hr. lab.
225. **Electric Circuits III.** 3 hr. PR: E.E. 125. Distributed circuits (transmission lines), steady state analysis of disturbed circuits, simulation of distributed circuits by lumped parameter circuits. Interpretation of transmission line as general four terminal network (A B C D constants), matrix methods of combination of four terminal networks, introduction of "modern" network analysis. 3 hr. rec.
226. **Electric and Magnetic Fields II.** 3 hr. PR: E.E. 126. Plane wave in dielectric media; plane waves in conducting media; transmission lines; wave guides; antennas. 3 hr. rec.
232. **Electromechanical Devices I.** 4 hr. PR: E.E. 125, 126. Fundamentals of electromechanical energy conversion. Transformers and rotating machines. 3 hr. rec., 3 hr. lab.
233. **Electromechanical Devices II.** 4 hr. PR: E.E. 232. Analysis of machine-performance by the principles of electromechanical energy conversion. 3 hr. rec., 3 hr. lab.
235. **Electrical Machinery.** 3 hr. PR: E.E. 232 or consent. Synchronous machines, windings, calculation of emf and mmf; mmf space functions. Potier diagram, ASA regulation, 2-reactance diagrams. Multiple-winding transformers and auto transformers. 2 hr. rec., 3 hr. lab.
236. **Electrical Machinery.** 3 hr. PR: E.E. 233 or consent. Commutation theory of machines, d-c and a-c multiple-winding and special purpose machines; multiple machine systems. 2 hr. rec., 3 hr. lab.

251. **Electronics II.** 3 hr. PR: E.E. 152, 225, 226. Analysis and synthesis of small signal R-C coupled and tuned amplifiers, cascade amplifiers, feedback amplifiers, large signal tuned and untuned amplifiers and oscillators. 2 hr. rec., 3 hr. lab.
252. **Electronics III.** 3 hr. PR: E.E. 251. Analysis of demodulation systems, wave-shaping circuits, electronic power-handling systems, photo-sensitive devices, and microwave devices. 2 hr. rec., 3 hr. lab.
253. **Physical Electronics.** 3 hr. PR: E.E. 152. A study of the physical principles of electrical conduction and the application of these principles to electronic conduction in solids, electron emission, and conduction in vacuum and gas. 3 hr. rec.
257. **Transistor Circuits.** 3 hr. PR: E.E. 251 or consent. Application of the basic principles of semiconductor electronics to junction and field-effect devices. Development of equivalent circuits for junction diodes, transistors and field-effect transistors. 3 hr. rec.
261. **Networks and Filters.** 3 hr. PR: E.E. 225 or consent. Analysis and synthesis of networks and filters. 3 hr. rec.
264. **Communications Engineering.** 3 hr. PR: E.E. 251 or consent. Communications systems, or systems used to transmit information. The underlying principles of modern information transmission systems are stressed. Emphasis is placed upon the fundamental role of system bandwidth and noise in limiting the transmission of information. 3 hr. rec.
270. **Engineering Analysis and Design.** 3 hr. PR: E.E. 232, 251. Formulation and application of the method of engineering analysis based upon fundamental physical laws, mathematics, and practical engineering considerations. Emphasis is placed on the professional approach to the analysis of engineering problems. 3 hr. rec.
271. **Theory of Digital Computers.** 3 hr. PR: Senior standing in Engineering Physics or Mathematics. Introduction to the field of digital computer design. Topics include general computer organization, number systems and number representations, design characteristics of major computer units, Boolean algebra and its application to computer design and sequencing of basic arithmetic processes in a computer. 3 hr. rec.
275. **Pulse Techniques.** 3 hr. PR: E.E. 152, 225. An introduction to the response of electrical networks to non-sinusoidal inputs, the analysis of active networks with large signals and the circuits and techniques used in pulse and digital equipment. Students will use the University's computing facilities by solving problems using ECAP. No previous programming is needed. 3 hr. rec.
280. **Electrical Problems.** 1-3 hr. For junior, senior, and graduate students.
281. **Electrical Power Systems.** 3 hr. PR: E.E. 226 or consent. Analysis of balanced polyphase systems, including transmission lines. Polyphase transformation. Principles of grounding and protection from lightning. 3 hr. rec.
282. **Symmetrical Components.** 3 hr. PR: E.E. 226 or consent. Analysis of poly-phase systems in unbalanced and transient conditions. 3 hr. rec.
285. **Electric Power Transmission and Distribution.** 3 hr. PR: E.E. 226. Circle diagrams applied to the various problems of power transmission; phase modifier applications and an introduction to power stability. 3 hr. rec.
286. **Fundamentals of Servomechanisms.** 3 hr. PR: E.E. 225. Fundamental analysis of the servomechanisms and automatic control devices. 3 hr. rec.
288. **Antennas.** 3 hr. PR: E.E. 226. Consent. Analysis and design of antenna systems. 3 hr. rec.

293. **Analogue Computers.** 3 hr. PR: Math. 140. A study of the theory and operation of analogue computers. Amplitude scaling and time scaling on the analogue computer and application of the analogue computer to the solution of differential equations. 3 hr. rec.
299. **Ultra-High Frequency Technology.** 3 hr. PR: E.E. 226 or consent. Study of special problems encountered at high and ultra-high frequencies. 3 hr. rec.
300. **Seminar.** 1-3 hr. PR: Consent. Each graduate student will give an oral description of his written research proposal soon after beginning his thesis research. This will typically be a 30-minute presentation before the faculty and graduate students.
301. **Electrical Power Systems.** 3 hr. PR: E.E. 281 or consent. Transient and steady-state stability of systems. Traveling waves on transmission lines; lightning and switching surges. The principles of the application of analog and digital computers to solution of power system problems. 3 hr. rec.
310. **Switching Circuit Theory I.** 3 hr. PR: Consent. This course, together with E.E. 311, provides the basis for mathematical switching theory. Boolean and abstract algebraic systems are developed from the postulational approach and applied to the theory of computers and automata. The emphasis is upon setting up of mathematical models and a careful study of their properties rather than upon logical design and/or techniques of computation. 3 hr. rec.
311. **Switching Circuit Theory II.** 3 hr. PR: E.E. 310. This course is a continuation of E.E. 310. 3 hr. rec.
313. **Design of Computer Arithmetic Circuits I.** 3 hr. PR: E.E. 271 or equiv. A detailed study of computer circuitry usable in performing binary arithmetic. This course deals with the logic, circuitry, and engineering aspects of digital computer equipment design. Primary emphasis is placed on the design of high speed, parallel arithmetic units using the natural binary number system. Additional topics include serial, binary coded decimal (ECD), modular, and floating point arithmetic systems. Recently announced computer circuitry will be discussed as publications become available. 3 hr. rec.
314. **Digital-Computer Arithmetic II.** 3 hr. PR: E.E. 313. A continuation of E.E. 313. 3 hr. rec.
325. **Advanced Linear Circuit Analysis.** 3 hr. PR: Consent. Systematic formulation of circuit equations. The use of operational techniques to find total solutions. Applications and characteristics of the Laplace and Fourier Transforms, Matrix algebra, complex variable theory and state variables are made to circuit analysis and elementary circuit synthesis. 3 hr. rec.
326. **Advanced Electric and Magnetic Field Theory.** 3 hr. PR: Consent. Solutions of Laplace's equation as applied to static fields; the application of Maxwell's equations to guided wave and antenna problems. 3 hr. rec.
327. **Theory of Guided Waves.** 3 hr. PR: E.E. 326. Transverse electromagnetic waves; propagation in cylindrical waveguides; in homogeneously filled waveguides; waveguide discontinuities. 3 hr. rec.
330. **Electrical Machinery.** 3 hr. PR: E.E. 235 or consent. Advanced theory of synchronous and induction machinery following Parks-Doherty-Nickel theory; applications of matrix algebra and tensor analysis. 3 hr. rec.
348. **Nonlinear Automatic Control Systems.** 3 hr. PR: Consent. The application of Liapunov's and Popov's methods to nonlinear control systems, together with classical techniques. 3 hr. rec.
350. **Electronic Circuits.** 3 hr. PR: E.E. 252. An advanced study for the analysis and design of electronic circuits; low-pass and band-pass amplifiers, single-tuned and double-tuned stages, equal ripple and maximally flat responses. 3 hr. rec.

351. **Physical Electronics.** 3 hr. PR: E.E. 253, 257 or consent. Application of the principles of physics to semiconducting materials, junctions between semiconductors and metals, and semiconductor junctions. The development of equivalent circuits for semiconducting devices. 3 hr. rec.
361. **Modern Network Synthesis.** 3 hr. PR: E.E. 325. Study of the basic methods of modern network synthesis using passive devices. Develops the concept of a positive-real function and applies this and complex variable theory to network synthesis. 3 hr. rec.
364. **Communication Theory.** 3 hr. PR: E.E. 264 or consent. Detailed study of probability theory and its use in describing random variables and stochastic processes. Emphasis is placed on applications to problems in communication system design. 3 hr. rec.
366. **Information Theory I.** 3 hr. PR: E.E. 364. Probability concepts; theory of discrete systems; encoding; theory of continuous systems; systems with memory; the fundamental theorem of information theory. 3 hr. rec.
367. **Information Theory II.** 3 hr. Continuation of E.E. 366. 3 hr. rec.
380. **Electrical Problems.** 1-6 hr. For graduate students.
386. **Feedback System Theory.** 3 hr. PR: E.E. 286, 325. Signal flow graphs; sensitivity; return difference; mathematical definition of feedback; effects of feedback; multiple loop systems; multivariate systems. 3 hr. rec.
387. **Sample-Data Control Systems.** 3 hr. PR: E.E. 386 or consent. A study of control systems in which the activating signal is represented by samples at regular time intervals. 3 hr. rec.
388. **Synthesis of Feedback Systems I.** 3 hr. PR: E.E. 364, 386. Methods of direct synthesis and optimization of feedback systems; Wiener theory; Pontryagin's maximum principle; dynamic programming; adaptive feedback systems. 3 hr. rec.
389. **Synthesis of Feedback Systems II.** 3 hr. Continuation of E.E. 388. 3 hr. rec.
390. **Advanced Independent Study.** 1-6 hr. PR: Consent. Individual investigation in advanced electrical engineering subjects that are not covered in formal courses.
391. **Vector Spaces in Linear Control Systems.** 3 hr. PR: Consent. Matrix theory and linear transformations as applied to linear control systems. The state-space on time-domain study of stability, controllability, observability, etc. 3 hr. rec.
397. **Research.** 1-15 hr. Advanced research or special investigations on some topic related to electrical engineering.

INDUSTRIAL ENGINEERING

Master of Science in Industrial Engineering

Students must comply with rules and regulations as outlined in general requirements for graduate work in the College of Engineering.

The M.S.I.E. degree program is designed to serve the graduate needs of a person holding a B.S.I.E. degree or an Industrial Engineering option in another field of engineering. Also, a person holding a degree in another field of engineering but who is willing to essentially fulfill the requirements of a B.S.I.E. degree may elect to pursue the M.S.I.E. degree. A review of the aims and objectives of each individual will permit exact evaluation of the courses required.

There are seven core areas of study available:

- Core I—Transportation Science
- Core II—Operations Research and Statistical Analysis

- Core III—Computer Applications
- Core IV—Human Factors Engineering
- Core V—Systems Analysis
- Core VI—Manufacturing Processes
- Core VII—General Industrial Engineering

Courses. No rigid curriculum is set up for the M.S.I.E. or M.S.E. degrees. At least half of the 30 hours required for either degree must be in courses in the Department of Industrial Engineering; this is exclusive of research. At least 12 hours must be courses included in the particular core area chosen. (Exception: In Core Area VII, at least half of the 30 hours must be in the 300 number series.) A minor may be selected in another core area, in another branch of engineering, in mathematics, or in the College of Commerce.

Thesis. A thesis is usually required of all candidates for either degree and in practically all cases it will be necessary to take all of the six hours of research work (I.E. 397). A thesis, however, is not automatically approved after the required number of semester hours of research work has been completed. The thesis must be presented in a form that conforms to the general requirements of the Graduate School, and in addition must conform to the additional thesis requirements of the department.

Thesis Supervisor. Each student will be assigned to a thesis supervisor who will normally serve as chairman of his Examining and Advisory Committee.

Final Examination. On completion of his thesis and course work, the candidate will be given an oral examination by his Examining and Advisory Committee; additional examiners may be called in for this examination.

Industrial Engineering

- 200. **Metal-Cutting Theory and Practice.** 3 hr. PR: I.E. 100 and Mat.E. 250. Metal-cutting tools, tool materials, work materials, cutting fluids, process of chip formation, cutting forces, tool-life tests, economics of tool life, measurement of product. 2 hr. rec., 3 hr. lab.
- 201. **Metal Forming Manufacturing Processes.** 3 hr. PR: I.E. 100 or consent. Applications and operations of the basic metal forming processes including the primary metal working processes and the metal shearing, drawing, binding, and squeezing processes, along with the machine tools required for these processes. 3 hr. rec.
- 205. **Metal Forming Theory.** 3 hr. PR: I.E. 201. The mechanics and basics of metal forming with elementary theoretical and descriptive investigations of tube-sinking, deep-drawing, wire-drawing, extrusion, cold rolling, and forging. 3 hr. rec.
- 207. **Metal Casting Manufacturing Processes.** 3 hr. PR: I.E. 100 and Mat.E. 250 or consent. Fluidity processes used in industry covering non-permanent processes such as sand molding, centrifugal molding, investment molding, and shell molding. Some permanent mold methods will be investigated along with metal processes, molding machines, and fundamentals of costing design. 3 hr. rec.
- 211. **Industrial Engineering Problems.** 1-3 hr. PR: Consent. Special problems relating to industrial engineering.
- *214. **Advanced Analysis of Engineering Data.** 3 hr. PR: I.E. 244. The application of advanced theories of statistical techniques to analyze and interpret industrial problems. Subjects include multiple regression, curvilinear regression, advanced analysis of variance, randomized complete blocks, Latin Square designs, factorial designs, transformations, and analysis of response curves. Accent is on proper design of experiments, proper interpretation of results, and thorough consideration of all errors of estimation and errors of inference. 3 hr. rec.

*Courses may be taken as undergraduate work by students in Colleges and Schools other than the College of Engineering.

- °215. **Statistical Decision Making.** 3 hr. PR or conc: I.E. 244 or consent. Basic concepts of probability theory, discrete and continuous distributions, joint and derived distributions, expectation, and properties of estimators. Special emphasis on the applications of probability theory in operations research, quality control, and human factors engineering. 3 hr. rec.
- 229. **Design of Dynamic Material Systems.** 3 hr. PR: I.E. 140, I.E. 142 or consent. The application of Industrial Engineering theory and practice to the selection of material systems and equipment. This is to include the efficient handling of materials from the first movement of raw materials to the final movement of finished product. Present quantitative design techniques will be included. 3 hr. rec.
- °244. **Engineering Statistics.** 3 hr. PR or conc: Math. 17. The use of graphical analysis; measures of central tendency and dispersion; normal, binomial, and Poisson distributions in engineering applications; linear regression and correlation; tests of significance, nonparametric statistics, and analysis of variance. Includes applications of statistical sampling techniques in quality control. 3 hr. rec.
- °250. **Electronic Computer Data Processing.** 3 hr. PR: Senior standing. Fundamentals of digital computer operations, equipment characteristics, input and output components. Elements of number systems. Fundamentals of "IR," information retrieval. Emphasis is placed on integrated systems analysis and design, business and industrial data for computer applications, and fundamentals of programming. Existing equipment systems and the economics of their applications will be reviewed.
- 253. **Analytical Techniques of Operations Research.** 3 hr. PR: I.E. 244. A study of the analytical techniques used in operations research and industrial engineering with special emphasis on their application to industrial systems and operations. The applications of matrix algebra, vectors and convex set theory to linear programming. Minimization techniques including differencing, differentiation of single and multiple integrals and Lagrangian multipliers with application to production and inventory problems. Markov Processes with applications to production problems and decision making. 3 hr. rec.
- °254. **Introduction to Operations Research.** 3 hr. PR: I.E. 244, and conc.: I.E. 142 or consent. Economic problems of production management, schematic models, linear programming, total value analysis, incremental analysis, Monte Carlo analysis, inventory theory, queuing theory, and game theory. 3 hr. rec.
- 256. **Introduction to Systems Engineering.** 1 hr. PR: I.E. 214, conc.: I.E. 254, I.E. 287. The nature of scientific methodology including: quantitative synthesis of models with accompanying objectives and restrictions, definition of terms, sampling and measurement of components of the model, development and testing of assumptions, optimization techniques, testing and controlling the model and the solution, and error sensitivity of the model. Emphasis will also be toward development of the problem-solver's ability to successfully assign resources to the problem solution phases in a manner such as to equalize the marginal cost of improving the model's reliability. This course will provide an opportunity for the student to analyze an operation as it may interact with the whole system. 1 hr. rec.
- °281. **Digital Computation for Engineers.** 3 hr. Conc: Math. 16. Study of processes of broadly integrating the digital computer into service for the engineer or scientist and study of the programming process with emphasis on coding with the automatic programming language Fortran. Considerable use will be made of the Computer Center equipment, especially the IBM 360 Model 75. Various other programming languages such as COBOL and ALGOL will be reviewed. Considerable time will also be devoted to topics such as real-time control, principles of computer functions, study of available equipment, board use categories of equipment, etc. 2 hr. rec., 3 hr. lab

282. **Advanced Digital Computer Concepts.** 3 hr. PR: I.E. 180 or 281 or consent. Principles of digital computer functional components. Study of digital operating systems including structure of the various subsystem components such as monitors, input output control systems, and loaders. Advanced operating system concepts including multiprogramming, multiprocessing, teleprocessing, and time sharing will be covered. Various existing operating systems will be evaluated as well as principles in overall system design. 3 hr. rec.
283. **Information Retrieval.** 3 hr. PR: I.E. 180 or 281 or consent. Study of the tools, elements, and theories of information storage and retrieval. Areas of study include documentation, information framework; indexing; elements of usage, organization and equipment; parameters and implementation; theories of file organization and system design. 3 hr. rec.
284. **Simulation by Digital Methods.** 3 hr. PR: I.E. 244 or consent and Fortran programming experience. An introduction to methods of simulation using the digital computer. Study of the methods of generating random numbers, the Monte Carlo technique, process generators, industrial dynamics models, methods of error analysis and reduction, and digital computer simulation languages such as Simscript, Dynamo, Fordyn, and especially GPSS (General Purpose System Simulator-III). The student will be provided the opportunity to use the digital computer to simulate moderately complex production, inventory, queueing, and maintenance systems. Although the primary emphasis is more practically restricted to models of industrial operations, the techniques are immediately adaptable to simulation of any physical or information system. Simulated experiments are also considered. 3 hr. rec.
- *287. **Engineering Economy.** 3 hr. PR: Junior standing. Comparison of the relative economy of engineering alternatives; compound interest in relation to calculation of annual costs; present worth and prospective rates of return on investments; methods of depreciation; sunk costs, increment costs; general economy studies with emphasis on retirement and replacement of equipment; consideration of taxes, public works, and manufacturing costs as related to economic solution of engineering proposals. 3 hr. rec.
- *288. **Job Evaluation and Wage Incentives.** 3 hr. PR: I.E. 140 or consent. Principles used in evaluating jobs, rates of pay, characteristics and objectives of wage incentive plans; incentive formulae and curves. 3 hr. rec.
- *290. **Industrial Statistics.** 2 hr. PR: I.E. 244. Economic objectives of quality control in manufacturing through sampling methods; the Shewhart control chart for variables, attributes, and defects per unit; statistical approach to acceptance procedures. 2 hr. rec.
292. **Plant Layout and Design.** 3 hr. PR: I.E. 142. Problems in industrial plant design. Equipment location, space utilization, layout for operation and control, flow sheets, materials handling. Allied topics in power utilization, light, heat, and ventilation. 1 hr. rec., 6 hr. lab.
- *294. **Standard Manufacturing Costs.** 3 hr. PR: I.E. 151. Development of standards for labor, material, and overhead expenses; uses of standards for control; analyses of variances between standard and actual costs. 3 hr. rec.
299. **Human Factors Engineering.** 3 hr. PR: Psychol. 115 or consent. An examination of human factors engineering and man-machine systems to include a study of ambient environment, human capabilities and equipment design. Application of human factors engineering in workplace design, maintainability, and task design methodology. Study of system design for man-computer interface, life support requirements, simulators and man-machine systems. 2 hr. rec., 3 hr. lab.

300. **Advanced Metal-Cutting Theory and Practice.** 3 hr. PR: I.E. 200. The development of metal-cutting as a science through research, cutting-fluid theory, machinability of materials, tool materials, hot machining, tool-life tests, economics of machining. 2 hr. rec., 3 hr. lab.
302. (C.E. 302.) **Traffic Flow Theory.** 3 hr. PR: I.E. 244 and C.E. 339 or consent. Topics to be included are hydrodynamic, car-following, and queueing theory models of traffic flow. Particular emphasis will be given to the applicability of these models to true traffic situations. Other topics to be covered will be traffic simulation, freeway flow models, expressway surveillance, pedestrian and traffic delay at traffic signals, turning at intersections, parking problems, merging traffic or limited access facilities. 3 hr. rec.
310. **Advanced Manufacturing Processes.** 3 hr. PR: I.E. 100. A study of the newer and more complex manufacturing methods used in industry today. Welding and forming of titanium, magnesium, beryllium, and similar metals; assembly processes; powder metallurgy; adhesives and bonds; roll milling; electrical and chemical operations such as electro-forming and hot-dipping operations; hot forging; high energy rate forming (HERF); automated manufacturing processes including transfer mechanisms, continuous, and point-to-point numerical control; plastic tooling and fabrication methods; marking processes; and other manufacturing processes will be examined. 3 hr. rec.
311. **Seminar.** 1-6 hr. PR: Consent. Discussion of research in Industrial Engineering and special problems.
312. **Automation in Industry.** 3 hr. PR: I.E. 100 or consent. The evolution, production fundamentals, and control systems of the principal fully automatic machine tools, both fixed and flexible, will be covered along with the basic philosophy, fundamentals, and methods of automation as practiced in industry today. 2 hr. rec., 3 hr. lab.
315. **Management Control.** 3 hr. PR: I.E. 151 or consent. A study of effective techniques for higher management control; a study of integrated and related control data to aid in establishing a preconceived goal. 3 hr. rec.
344. **Advanced Design of Industrial Experiments.** 3 hr. PR: I.E. 214. A study of several of the more complex statistical methods including sequential analysis, analysis of covariance, multiple range tests, transformation of data, orthogonal polynomials, large factorial experiments, confounding, fractional replication, split-plot designs, lattice designs with one and two restrictions on treatment allocation, with special emphasis on the power, relative efficiency, and interpretation of these designs.
350. **Queueing Theory.** 3 hr. PR: I.E. 215 and 244. Best operating conditions for systems involving waiting times. Elements of stochastic processes. Single-channel and multi-channel models. Computational methods, including Monte Carlo techniques. Applications to problems such as maintenance and inventory control. 3 hr. rec.
351. **Theory of Linear Programming.** 3 hr. PR: I.E. 244 and I.E. 253 or consent. Extreme point solutions and their generation. Development of the simplex procedure. Duality problems in linear programming. Revised simplex procedure. Degeneracy procedures. Transportation problems. Selected topics related to linear programming. 3 hr. rec.
352. **Inventory Theory.** 3 hr. PR: I.E. 215, 254. A study of techniques used in the optimization of inventory systems. Elements of static, deterministic inventory models, and static, stochastic inventory models. Dynamic inventory models. Selected topics related to inventory analysis. 3 hr. rec.
353. **Applied Mathematical Programming.** 3 hr. PR: I.E. 254 or consent. Application of the assignment, transportation, and simplex algorithms to typical industrial and economic problems. The methods and computational efficiencies of the revised simplex and other algorithms are also studied and compared with the

conventional methods. Computational methods of duality and the dual-simplex and primal-dual algorithms are covered. The following special topics are also included: effect of changes or addition of vectors, secondary constraints, the decomposition principles, fixed charges (intercepts), upper bound constraints, and transshipment. 3 hr. rec.

354. **Special Topics in Systems Analysis and Operations Research.** 3-6 hr. PR: Consent. Special topics from recent developments in operations research and related fields. Special emphasis will be placed on interests of current graduate students.
355. **Applied Stochastic Processes.** 3 hr. PR: I.E. 215, I.E. 253, I.E. 356. Study of stochastic systems with particular emphasis on application to inventory and queueing theory. Areas of study include conditional probability, Poisson processes, counting processes, renewal processes, Markov chains with discrete and continuous parameters.
356. **Probability Theory for Engineers.** 3 hr. PR: I.E. 215. Study of probability theory and its application to industrial systems with particular emphasis on inventory systems, queueing models, maintenance, reliability, and quality control. Areas of study include mathematical models of random phenomena, basic probability theory, mean and variance of a probability law, probability laws and their application to inventory and queueing theory, expectation of a random variable, cost and profit as functions of random variables.
361. **Methods Analysis and Work Simplification.** 3 hr. PR: I.E. 140, 287. An advanced study of the techniques of methods analysis, including modern means of methods research. Development of appropriate cost analyses to accompany improved operating plans. A study of the design, installation, and administration of work simplification programs, suggestion systems, and remuneration policies, and the means of intra-plant communications concerning such programs. 2 hr. rec., 3 hr. lab.
370. **Theory of Industrial Engineering and Organization.** 3 hr. PR: Graduate standing and consent. History and development of scientific management in industry with early works of Taylor, Galbreth, and Gantt, to the present time. 3 hr. rec.
371. **Methods Analysis.** 2 hr. PR: I.E. 140 or consent. An advanced study of the techniques of methods analysis as an effective means of methods improvement and cost reduction. 2 hr. rec.
372. **Advanced Time Study.** 3 hr. PR: I.E. 140. Review of the various investigations which have been made, with special consideration given to the development of these studies into new fields. 3 hr. rec.
373. **Budget Control.** 3 hr. PR: I.E. 294. Principles involved in the preparation of budgets by functional divisions and the application of divisional budgets as control media. 3 hr. rec.
374. **Advanced Engineering Economy.** 3 hr. PR: I.E. 287. Special emphasis on depreciation, engineering and economic aspects of selection and replacement of equipment; relationship of technical economy to income taxation and load factor and capacity to economy. 3 hr. rec.
380. **Integrated Data Processing.** 3 hr. PR: I.E. 281 and consent. Advanced work in electronic data-processing systems and procedures design. Case studies of integrated data-processing systems. Course projects will include individual use of a computer in management data-processing analysis problems. 3 hr. rec.
381. **Digital Computer Applications.** 1 hr. PR: Graduate standing in Engineering, Physical Science or Mathematics. Introduction to methods of digital computation and study of the programming process with emphasis on coding with an automatic programming language for scientific problems (FORTRAN). The

student will have considerable opportunity to analyze engineering and scientific problems using the facilities available at the University Computer Center. 2 hr. rec., 3 hr. lab. (5-week period.)

- 390. **Advanced Industrial Statistics.** 3 hr. PR: I.E. 244. Advanced study of the economic application of statistics to quality control problems. Particular emphasis on developing models of quality control systems on the basis of statistical decision theory. Double and sequential sampling by attributes. Variables sampling plans. Advanced control chart methods. 3 hr. rec.
- 397. **Research.** 1-15 hr. Investigation or original research on some special topic relating to industrial engineering.
- 398. **Advanced Problems in Human Factors.** 1-3 hr. PR: I.E. 299 or 399 and graduate standing. Special problems relating to one of the areas of human factors such as simulation, controls, vigilance, maintainability, etc.
- 399. **Human Factors System Design.** 3 hr. PR: I.E. 299. A study of the theoretical aspects and practical applications of man/machine relationships as they influence future system design. In this course the student will examine human limitations with respect to the acceptance of information, decision making, and the ability to transmit the result of such decisions to the controlled equipment systems for the purpose of obtaining design optimization. 2 hr. rec., 3 hr. lab.

MECHANICAL ENGINEERING

Students must comply with the rules and regulations as outlined in the general requirements for graduate work in the College of Engineering. A graduate student electing Mechanical Engineering as his major should have had the equivalent of an E.C.P.D.-accredited undergraduate degree in Mechanical Engineering or be willing to remove any deficiencies prior to starting on a graduate program. In addition, a graduate student in the Department of Mechanical Engineering must comply with the departmental requirements as outlined below.

Master of Science in Mechanical Engineering

Courses. No rigid curriculum is set up for the M.S.M.E. degree. Certain general requirements must be met, however, by all candidates for this degree. Each student, in concert with his adviser, is expected to develop a plan of study, as soon as possible, indicating his courses and the area of his thesis interest. The plan should include at least six semester hours of advanced mathematics beyond differential equations and may also include courses in physics or chemistry in the 200 or 300 series. A minimum of twelve hours should be taken in Mechanical Engineering courses, with two-course depth in at least one major area. The remaining courses may be selected from other departmental offerings in the College of Engineering when particularly suited to the objectives of the student. In general, at least one-half of the hours listed in the plan should be at the 300-level. No 200-level course that is required in the undergraduate curriculum in Mechanical Engineering may be taken for graduate credit. Any deviation or modification of the plan shall be subject to prior approval of the adviser.

Thesis. A thesis is normally required of all candidates for the degree of Master of Science in Mechanical Engineering.

Final Examination. Each candidate for the M.S.M.E. degree shall be required to pass a final examination administered by his advisory committee. This examination may be written or oral or both and may cover material in the courses or thesis area of the student.

The Degree of Doctor of Philosophy

Students intending to pursue a Ph.D. program in Mechanical Engineering should have earned a B.S. or M.S. degree in Mechanical Engineering or an equivalent curriculum. While it is possible for a student with a B.S. degree to enroll directly

in the Ph.D. program, it is usually advisable for him to earn the M.S.M.E. first. An exception might be indicated for anyone planning to enter the teaching profession or on a special doctoral support program.

As with the M.S.M.E. program, the courses of study are selected to fit the individual interests and objectives of the student, with proper attention given to the rounding out of related areas of study.

The research work for the doctoral dissertation is expected to represent a significant contribution to the art or science of engineering. It may entail a fundamental investigation into a specialized area, or a broad and comprehensive study of a novel system design. In either case, a high degree of creative and original effort is required to meet the standards of acceptability.

The student must pass a final examination in defense of his dissertation administered by his research committee.

Mechanical Engineering

- 204. **Mechanical Vibrations.** 3 hr. PR: Math. 140 and T.A.M. 104 or consent. Fundamentals of vibration theory. Free and forced vibration of one, two and multiple degree of freedom systems, transient analysis. Solution by Fourier and Laplace Transformation. Methods of Rayleigh, Holzer, and Stodola. Conservative systems and LaGrange's equation. 3 hr. rec.
- 205. **Kinematics.** 3 hr. PR: M.E. 112 and Math. 140 or consent. Geometry of constrained motion, kinematic synthesis and design, spacial linkages. Coupler curves, inflection circle, Euler-Savary equation, cubic of stationary curvature and finite displacement techniques. 3 hr. rec.
- 224. **Steam Turbines.** 3 hr. PR: M.E. 125. The theory of fluid dynamics and the thermodynamics of the modern turbines; materials, construction details and design of important elements; influences on economy of variations in cycles and operative ranges. 3 hr. rec.
- 225. **Problems in Thermodynamics.** 3 hr. PR: M.E. 125 or consent. Detailed study of thermodynamics systems with special emphasis on actual processes. The problems presented are designed to strengthen the background of the student in the application of the fundamental thermodynamic concepts. 2 hr. rec., 3 hr. lab.
- 231. **Introduction to Gas Dynamics.** 3 hr. PR: M.E. 125 or M.E. 121, Math. 140. The basic fundamentals of gas dynamics, one-dimensional gas dynamics and wave motion, methods of measurement, effect of viscosity and conductivity, and concepts from gas kinetics. 3 hr. rec.
- 235. **Heat Transfer II.** 3 hr. PR: M.E. 230. A continuation of M.E. 230, covering nonlinear extended surface; gas radiation; freezing; heat exchanger theory; recovery factor and high speed flow; and mass transfer. Also, periodic flow and application of the digital computer to problems in heat transfer. 3 hr. rec.
- 250. **Heating, Ventilating, and Air Conditioning.** 3 hr. PR: M.E. 125 or consent. Methods and systems of heating, ventilating, and air conditioning of various types of buildings, types of controls and their application. 3 hr. rec.
- 260. **Introductory Engineering Systems Analysis.** 3 hr. PR: Senior standing. A study of analogous and mixed systems. Similitude of mechanical, electrical, and acoustic dynamic systems. Dimensional analysis and theory of model design. 3 hr. rec.
- 265. **Engineering Acoustics.** 3 hr. PR: Math. 140 and consent. Use of fundamental principles of mathematics and physics to develop the basic theories of sound. Application of these theories involving sound in closed areas, the various modes of sound transmission, noise control and psycho-acoustic criteria. 3 hr. rec.
- 271. **Introduction to Feedback Control Theory.** 3 hr. PR: M.E. 125 or M.E. 121 and C.E. 115 or conc.: C.E. 115. Use of fundamental properties of fluids and

fluid flow in the operation of power control systems. The theory and design of hydraulic and air operated control components with special emphasis on automatic circuits. 3 hr. rec.

280. **Mechanical Problems.** 1-6 hr. For junior, senior, and graduate students.
290. **Seminar.** 1-6 hr. PR: Junior, senior, or graduate status and consent.
291. **Seminar.** 1-6 hr. PR: Junior, senior, or graduate status and consent.
294. **Special Topics.** 1-6 hr. PR: Junior, senior, or graduate status and consent.
295. **Special Topics.** 1-6 hr. PR: Junior, senior, or graduate status and consent.
300. **Seminar.** 1-3 hr. PR: Consent. Discussion, library readings, and individual study reports in the mechanical engineering field.
303. **Advanced Machine Design.** 3 hr. PR: M.E. 203. Stresses in indeterminate machine parts, experimental stress analysis. Design for high temperatures, pressures and speeds. Bearings and lubrication. Rotating discs and elastic stability and high speeds. Residual stresses and creep. 3 hr. rec.
304. **Advanced Vibrations.** 3 hr. PR: M.E. 204 or consent. Dynamic and harmonic analysis of multiple degree of freedom and continuous linear systems. Lagranges equations and matrix techniques. Use of analog and numerical techniques. 3 hr. rec.
305. **Random Vibrations.** 3 hr. PR: M.E. 204 or consent. Characterization of random motion. Response of linear time invariant systems. First and second failure problems. Fatigue under random excitation. 3 hr. rec.
320. **Advanced Thermodynamics I.** 3 hr. PR: M.E. 125. Definitions and scope of thermodynamics. First and Second laws, Maxwell's relation, Calpeyron relations, equation of state, thermodynamics of reactive systems, availability.
321. **Advanced Thermodynamics II.** 3 hr. PR: M.E. 320 or consent. Methods of statistical mechanics; concept of temperature; perfect diatomic gases and crystalline solids, Jacobian equations of thermodynamics; grand potential function; inherently irreversible processes.
325. **Irreversible Thermodynamics I.** 3 hr. PR: M.E. 320 or consent. Phenomenological treatment of the laws of dynamics and thermodynamics for irreversible processes in continuous media. The linear laws for combined irreversible phenomena including viscous dissipation, heat conduction, diffusion, chemical reactions and electric and magnetic effects, are developed taking into account Curie's principle and the Onsager relations. The principle of the minimum rate of creation of entropy is extended to establish criteria for the stability of stationary states. Tensor and variational methods are employed.
326. **Irreversible Thermodynamics II.** 3 hr. PR: M.E. 325. A continuation of M.E. 325 with emphasis on selected topics from such applications as thermoelectricity, anisotropic heat conduction, stability of fluid motion, thermal diffusion and separation, visco-chemical drag, electro chemical cells, and other coupled phenomena of physical or biological interest.
330. **Conduction Heat Transfer.** 3 hr. PR: M.E. 230 or consent. Analytical, numerical, graphical, and analog solutions of steady and non-steady heat conduction problems in isotropic and anisotropic solids. Representative topics include: thermal properties, extended surfaces, thermal stress, interphase conduction with moving interface, localized and distributed sources.
331. **Convection Heat Transfer.** 3 hr. PR: M.E. 230 or consent. Rigorous study of the fundamental mechanisms of the heat convection processes in both laminar and turbulent flows. Analytical, numerical, and analogical solution as applied to convective systems. Selected topics for discussion as related to student interest and study of current research publications.

332. **Radiation Heat Transfer.** 3 hr. PR: M.E. 230. Classical derivation of black body radiation laws; grey body and non-grey analysis; radiant properties of materials, radiant transport analysis, specular-diffuse networks, gas radiation, thermal radiation measurements: analytical, numerical solutions, and study of selected current publications.
351. **Advanced Internal Combustion Engines.** 3 hr. PR: M.E. 229 or consent. Combustion in spark ignition engines; compression ignition engines; detonation; fuel-air ratios; heat losses; lubrication; efficiencies; two-stroke engines; four-stroke engines. performance, exhaust turbines; gas turbines. 3 hr. rec.
352. **Turbomachinery.** 3 hr. PR: M.E. 121 or M.E. 125. A study of flow problems encountered in the design of water, gas, and steam turbines, centrifugal and axial flow pumps and compressors, design parameters.
354. **Advanced Refrigeration.** 3 hr. PR: M.E. 250. Thermodynamics of vapor cycles, refrigerants, fluid flow, heat transfer, psychometrics, types of refrigeration and equipment required, application of refrigeration in industry, food preservation. 3 hr. rec.
360. **Engineering Similitudes.** 3 hr. PR: Consent. Development of the dimensional analysis concepts and techniques and their application in model design. Rational approach to the design of distorted models. Study of analogies from a standpoint of model-prototype relations. 3 hr. rec.
397. **Research.** 1-15 hr. Investigation or original research on some topic relating to mechanical engineering.

THEORETICAL AND APPLIED MECHANICS

Master of Science in Theoretical and Applied Mechanics

Students must comply with rules and regulations as outlined in the Guide to the Graduate Program in Engineering.

Courses. At least 30 semester hours are required for the degree of Master of Science in Theoretical and Applied Mechanics. At least 12 of these hours, exclusive of thesis, must be in the Department of Theoretical and Applied Mechanics. As many courses as are possible should be those restricted to graduate students only. A minor in one of the other branches of engineering, physics, or mathematics is possible.

Thesis. A thesis is usually required for the degree of Master of Science in Theoretical and Applied Mechanics, and is ordinarily for 6 hours credit. The thesis must conform to the general requirements of the Graduate School and to the additional requirements of the Department.

Thesis Supervisor. Each student will be assigned a thesis supervisor who will serve as chairman of his thesis committee.

Final Examination. On completion of his thesis, the candidate for the degree of Master of Science in Theoretical and Applied Mechanics will be given an oral examination by his thesis committee. Additional examiners may be called in for this examination.

The Degree of Doctor of Philosophy

Graduate students electing Theoretical and Applied Mechanics as their major must have had the equivalent of the undergraduate courses in mechanics required for a bachelor's degree in any of the curricula in the College of Engineering.

A graduate student who has received a Master's degree from a school which has an undergraduate curriculum in the area of his Master's degree accredited by E.C.P.D. may pursue a Ph.D degree in Theoretical and Applied Mechanics if he meets the other requirements of the Department.

Candidates for the Doctor of Philosophy degree, regardless of their specific major, must attain a proficiency in each of the following areas: (1) mechanics of solids, (2) mechanics of fluids, (3) dynamics, (4) experimental mechanics, and (5) applied mathematics.

Theoretical and Applied Mechanics

200. **Advanced Mechanics of Materials I.** 3 hr. PR: T.A.M. 103 or consent. Energy methods; localized stresses; curved flexural members; torsion of noncircular sections; thick-walled cylinders and rotating disks; contact stresses. 3 hr. rec. Offered each fall.
201. **Theory and Application of Oscillatory Phenomena.** 3 hr. PR: T.A.M. 104. Study of oscillations or vibrations in acoustical, electrical, hydraulic and mechanical systems. 3 hr. rec. Offered spring of even years.
202. **Advanced Laboratory.** 3 hr. PR: Consent. Applied engineering measurements and instrumentation dealing with mechanical phenomena as force, displacement, pressure, torque, velocity, and acceleration. Introduces students to various transducer, signal conditioning, and readout equipment. Time allowed for term project of specific student interest. Offered spring of even years.
203. **Experimental Stress Analysis.** 3 hr. PR: T.A.M. 103, 104. Introduction to some of the more common experimental methods of analyzing stress distributions. Classical photoelasticity, brittle lacquers, birefringent coatings, strain gage techniques and instrumentation, as applied to problems involving static, dynamic and stress distributions. 2 hr. rec., 3 hr. lab. Offered each fall.
250. **Intermediate Dynamics.** 3 hr. PR: Math. 253, T.A.M. 104. Brief review of vectorial mechanics with emphasis on the dynamics of systems of particles and applications such as the motion of a rocket and orbital mechanics. Derivation of Lagrange's Equations from the principle of virtual work and D'Alembert's Principle and the application of these equations to engineering problems involving conservative and nonconservative systems. 3 hr. rec. Offered each fall.
280. **Special Problems in Mechanics.** 1-3 hr. PR: T.A.M. 103 and consent. For junior, senior, and graduate students. Offered every semester and summer.
302. **Analytical Methods in Engineering I.** 3 hr. PR: Consent. A course designed to provide training in the applications of modern mathematics to engineering problems. Course content includes: index notation for determinants, matrices, and quadratic forms; linear vector spaces; linear transformations; eigen-value problems. Offered each fall.
303. **Analytical Methods in Engineering II.** 3 hr. PR: T.A.M. 302 or consent. Usually a continuation of T.A.M. 302. Course content includes: linear algebra, theory of functions, limits, continuity, and convergence; Banach and Hilbert spaces; functionals; representation theorems; applications to engineering problems. Offered each spring.
310. **Advanced Mechanics of Materials II.** 3 hr. PR: Consent. Membrane stresses in shells; bending of flat plates; two-dimensional elasticity; beams on elastic supports. 3 hr. rec. Offered each spring.
312. **Inelastic Behavior of Engineering Materials.** 3 hr. PR: T.A.M. 200. Rheological aspects of inelastic behavior, inelastic load-stress relationship for members subjected to axial, bending, torsion and buckling loads. Analytical stress-strain relationships and material modeling. Combined loading, interaction curves and their use. Statically indeterminate members loaded inelastically; inelastic buckling theory. 3 hr. rec. Offered fall of even years.
314. **Theory of Buckling.** 3 hr. PR: Consent. Fundamental theorems for the investigation of stability of mechanical systems. Application to discrete systems and development of stability equations for elastic bodies. 3 hr. rec. Offered spring of even years.
316. **Energy Methods in Applied Mechanics.** 3 hr. PR: Consent. Introduction to variational principle of mechanics and applications to engineering problems; principle of virtual displacements, principle of minimum potential energy, principle of complementary energy. Castigliano's theorem, Hamilton's principle. Applications of energy principles to stress analysis and problems of dynamics. 3 hr. rec. Offered each fall.

318. **Continuum Mechanics.** 3 hr. PR: Undergraduate mechanics and Math. 253. A course designed to emphasize the basic laws of physical behavior of continuous media. Course content to include: analysis of stress; equations of motion and boundary conditions; kinematic analysis; rates of strain, dilatation and rotation; bulk time, rates of change; constitutive equations with special attention to elastic bodies and ideal fluids; energy equations and the first law of thermodynamics. 3 hr. rec. Offered each fall.
319. **Non-Linear Continuum Mechanics.** 3 hr. PR: T.A.M. 318 or consent. Study of the basic laws of continuous media in the language of generalized tensors. Emphasis on the structure of the constitutive equations for various classes of media with particular attention to elastic, plastic and viscoelastic media. 3 hr. rec. Offered spring of even years.
320. **Theory of Elasticity I.** 3 hr. PR: Math. 253 or consent. A basic solid mechanics course to include: Cartesian tensors; equations of classical elasticity, energy, minimum, and uniqueness theorems for the first and second boundary value problems; St.-Venant principle; extension, torsion, and bending problems. 3 hr. rec. Offered each fall.
321. **Theory of Elasticity II.** 3 hr. PR: T.A.M. 320. Continuation of T.A.M. 320 to include: equations of classical elasticity in generalized coordinates; complex variables and potentials; plane stress and strain; various special problems. 3 hr. rec. Offered each spring.
324. **Theory of Thin Shells.** 3 hr. PR: Consent. Theoretical basis for analysis of shell-type structures. Material includes differential geometry of surfaces, current shell theories, and stability criteria. 3 hr. rec. Offered spring of odd years.
330. **Instrumentation in Engineering I.** 3 hr. PR: T.A.M. 104 or equiv. Theory of measuring systems, emphasizing measurement of rapidly changing force, pressure, strain, temperature, vibration, etc. Characteristics of currently available instruments, methods of noise elimination, types of recording are studied. Students in small groups in laboratory operate modern instruments for first-hand experience. Of special value to students who will do an experimental thesis. 2 hr. rec., 3 hr. lab. Offered each spring.
331. **Instrumentation in Engineering II.** 3 hr. PR: T.A.M. 330. Continuation of T.A.M. 330 with emphasis on transducers for static and dynamic measurement, and their use in practical measuring systems. 3 hr. rec. Offered fall of odd years.
340. **Photoelasticity.** 3 hr. PR: T.A.M. 200, 203. Theory of optics, birefringence, stress-optic law, polariscope, compensation. Techniques of model making, photography, polariscope use. Photoelastic coating methods and use of various reflective polariscopes. Data interpretation by various methods including principal stress separation by shear difference and graphical integration. 2 hr. rec., 3 hr. lab. Offered fall of odd years.
342. **Biomechanics Seminar I.** 3 hr. PR: Consent. Introduction to the principles and terminology of biomechanics, guest lecturers in anatomy, physiology, and biology; critical review of research papers of current interest and a consideration of the sources and forms of the literature. 3 hr. rec. Offered each fall.
343. **Biomechanics Seminar II.** 3 hr. PR: T.A.M. 324 or consent. Continuation of T.A.M. 342 with emphasis on the medical applications of engineering and the techniques of mathematical modeling to biological systems. 3 hr. rec. Offered each spring.
350. **Advanced Dynamics I.** 3 hr. PR: T.A.M. 250. Continuation of T.A.M. 250. Mechanics of rigid bodies; theory of moments of inertia, angular momentum and kinetic energy. Poinsot's interpretation of torque-free motion, Euler's angles, Euler's dynamical equations, pitch, roll, yaw, spinning top, gyroscopes, etc. 3 hr. rec. Offered every spring.

351. **Advanced Dynamics II.** 3 hr. PR: Consent. Dynamics of continuous solids. Wave motion; study of string motion in detail in order to introduce methods for attacking more general problems such as vibration of beams, membranes and plates. Stress propagation in unlimited solids; dilatational, distortional, and surface waves. 3 hr. rec. Offered fall of odd years.
360. **Flow of Non-Viscous Fluids.** 3 hr. PR: Consent. Introduction to potential theory, conservative force fields, continuity equation, energy equation, equation of state, ideal fluid. Derivation of Bernoulli equation. Complex variable with applications in potential flow. 3 hr. rec. Offered each fall.
361. **Flow of Viscous Fluids.** 3 hr. PR: Consent. Derivation of the Navier-Stokes equations, continuity equations, equation of state, energy equation, energy dissipation, boundary layer phenomena. Simultaneous mass and heat transfer at the fluid boundaries. 3 hr. rec. Offered in spring of odd years.
380. **Advanced Independent Study.** 1-3 hr. PR: Consent. Individual investigation, either analytical or experimental, in one or more phases of advanced mechanics. Offered each semester and summer.
397. **Research.** 1-15 hr. Advanced research or special investigations on some topic related to mechanics. Offered each semester and summer.

MINES

The School of Mines offers graduate curricula leading to the Master of Science degree in two fields—mining engineering and petroleum engineering. A student desiring to take courses for graduate credit in the School of Mines must first apply for admission to the Graduate School, and state the major field of his choice.

An applicant with a baccalaureate degree or its equivalent in the major field corresponding to the graduate study desired, from a department accredited by the Engineers' Council for Professional Development, will be admitted on the same basis as graduates of West Virginia University. Lacking these qualifications, an applicant must first fulfill the School of Mines' requirements in the field in which he is seeking an advanced degree.

Approval for candidacy for a graduate degree by faculty action is required to establish eligibility for a degree. A graduate student may request approval by formal application after completing a minimum of 12 semester hours of graduate courses with a grade-point average of at least 3.0 (B), based on all graduate courses in residence for which final grades have been recorded.

Academic Standards. No credits are acceptable toward an advanced degree which are reported with a grade lower than "C." To qualify for an advanced degree, a graduate student must have a grade-point average of at least 3.0 based on all courses completed in residence for graduate credit. Each candidate for a degree must select a major subject and submit a thesis showing marked attainment in that field.

Engineering of Mines

200. **Elements of Mineral Conservation. I.** 3 hr. PR: Open to any student in the University with junior standing. A study of the future demands for mineral resources including coal, water, oil, gas, ores, and industrial minerals and the causes of mineral loss in production and utilization and how to avoid or minimize them.

201. **Fire Control Engineering.** II. 3 or 4 hr. PR: Senior standing in an engineering curriculum or consent. The aspects involved in the control from fire, explosion and other related hazards. Protective considerations in building design and construction. Fire and explosive protection organization including fire detection and control. Lectures 3 and/or 3 hr. lab.
207. **Introductory Seismology.** I. 1 hr. PR: Physics 102. Earthquakes and the causes and area distribution; theory of elastic waves; the principles of seismograph construction, adjustment, and operation, interpretation and calculation of seismograms with exercises provided by records of the University seismograph station. 1 hr. rec.
209. **Mineral Preparation.** II. 3 hr. PR: T.A.M. 104, C.E. 115, or consent. Principles of preparation, beneficiation, and concentration of metallic and non-metallic ores for further processing or utilization. 2 hr. rec., 3 hr. lab.
212. **Advanced Mining.** II. 3 hr. PR: E.M. 108, E.E. 105. Engineering principles, methods and equipment applied to mine transportation, hoisting, and drainage. 3 hr. rec.
213. **Mine Ventilation.** I. 3 hr. PR: E.M. 108, T.A.M. 104, and C.E. 115. Principles, purposes, methods and equipment pertaining to the ventilation of mines. 2 hr. rec., 3 hr. lab.
215. **Industrial Safety Engineering.** I. 2 hr. PR: Junior standing or consent. Analysis of problems of industrial safety and accident prevention, laws pertaining to industrial safety and health, compensation plans and laws, and industrial property protection. 2 hr. rec.
217. **Coal Preparation.** I. 3 hr. PR: E.M. 209. Formation of coal, rank classification of coal, coal petrography, principles of preparing and beneficiating coal for market with laboratory devoted to sampling, screen analysis, float and sink separation, and use of various types of coal cleaning equipment. 2 hr. rec., 3 hr. lab.
218. **Advanced Mineral Preparation.** I. 3 hr. PR: E.M. 209. The theory and practice of concentration of ores, and industrial minerals with special consideration to the more recent advances in the beneficiation of both ores and coal. 2 hr. rec., 3 hr. lab.
219. **Advanced Mining Methods for Vein Deposits.** II. 3 hr. PR: E.M. 108, T.A.M. 104. Methods and systems of mining other than flat seams. Emphasis placed on selection of methods in relation to cohesive strength of ore bodies and their enclosing wall rocks. Mining of anthracite is included. 3 hr. rec.
220. **Mine Design.** II. 3 hr. PR: E.M. 212, E.M. 241. A comprehensive design problem involving underground mining developments or design of surface plant or both, as elected by the student in consultation with the instructor. A complete report on the problem is required including drawings, specifications, and cost analysis. 9 hr. lab.
222. **Mine Equipment and Machinery.** II. 3 hr. PR: E.E. 205, E.M. 212. Selection, installation, operation, and maintenance of mining equipment. 3 hr. rec.
223. **Mine Management.** II. 3 hr. PR: Math. 140, E.M. 212 and senior standing. Economic, governmental, social, and labor aspects of mining as related to the management of a mining enterprise. 3 hr. rec.
224. **Mining Engineering Problems.** I, II. 1-6 hr. PR: Senior or graduate standing. Investigation and detailed report in a special problem in mining engineering related to coal mining or mineral mining. Supervision and guidance by a member of the graduate faculty.
228. **Mine Equipment and Machinery Controls.** I. 3 hr. PR: E.M. 222 or consent. Principles, application and use of electric and hydraulic devices and circuits for protection and control of mine machinery and equipment. 3 hr. rec.

229. **Advanced Mining Equipment Applications.** II. 3 hr. PR: E.M. 228. Structural, mechanical, hydraulic and electrical characteristics of the more common items of mining equipment. Controls, electrical and hydraulic circuits, and mechanical transmissions with associated problems. Laboratory design of a control system for a mining machine. 2 hr. rec., 3 hr. lab.
230. **Elements of Geophysical Prospecting.** I. 3 or 4. PR: Geol. 1, Physics 11. Principles, calculations and application of methods for locating subsurface oil, gas, and mineral deposits.
241. **Mechanics of Ground Control in Mines.** I. 3 hr. PR: T.A.M. 102, Math. 140, E.M. 108 or consent. Structure of the earth's crust, bedding planes, joints, heterogeneity, mechanical properties of rocks, stress-time-deformation relationships in rocks, theoretical stress distribution about mine openings, practical effects, factors in mine pillar design, pillar bursts, creeps and squeezes, mining subsidence. 2 hr. rec., 3 hr. lab.
- 301, 302. **Advanced Mine Design.** I, II. Credit arranged. Advanced detail design and layout of coal mine plant, particularly incorporating new ideas of machines and mining methods.
351. **Coal Mining.** S. 3 hr. PR: Chemistry, 10 hr.; Physics, 8 hr.; and accompanied or preceded by general geology. Especially for students who are planning to teach mining subjects in high school. Not open to students taking E.M. 108 or 212. Hours arranged.
- 395, 396. **Graduate Seminar in Coal Mine Operation and Administration.** I, II. 3-6 hr. PR: B.S. degree and consent of Committee. Group discussion and analysis of problems related to the production, preparation, marketing, and utilization of coal with special assignments and emphasis in accordance with personnel background and field of interest of the individual student.
397. **Research.** I, II. Credit arranged. Individual problem in some phase of mining. Carefully prepared report required.

Petroleum Engineering

206. **Natural Gas Engineering.** I. 3 hr. PR: Pet.E. 106, C.E. 115. Principles of natural gas production, transmission, distribution, processing, regulation, measurement, storage and analysis with a laboratory devoted to the principles of the equipment utilized in the above named operations. 2 hr. rec., 3 hr. lab.
216. **Petroleum Engineering Design.** II. 3 hr. PR: Pet.E. 232, Material Engr. 250. A comprehensive problem in design involving systems in oil and gas production, field processing, transportation and storage. Three 3-hr. labs.
224. **Petroleum Engineering Problems.** I, II. 1-6 hr. PR: Senior or graduate standing. Investigation and detailed report on a special problem in petroleum or natural gas engineering. Supervised by a member of the graduate faculty.
232. **Petroleum Reservoir Engineering.** I. 5-6 hr. PR: Pet.E. 236. Concepts and applications of properties of rocks and rock-fluids systems which are fundamental to engineering analysis of petroleum reservoirs, mechanics of fluid flow in porous media, production of depletion drive, by frontal displacement, by water drive, and by segregation drive. 5 hr. rec., 3 hr. lab.
235. **Fundamentals of Well Logging.** II. 3 hr. PR: Math. 140, Pet.E. 106, or consent. Principles of the various well logging methods and related calculations with exercises in interpretation of data from actual well logs. 2 hr. rec., 3 hr. lab.
236. **Mechanics of Hydrocarbon Fluids.** II. 3 hr. PR: Physics 102, C.E. 115, E.M. 102, Pet.E. 106, Chem. 141. The qualitative and quantitative phase behavior of single and multicomponent hydrocarbon systems with emphasis on application to petroleum production engineering and petroleum reservoir engineering. 2 hr. rec., 3 hr. lab.

237. **Composition and Properties of Oil Well Drilling Fluids.** II. 2 hr. PR: Pet.E. 106, Chem. 141 and C.E. 115. Principles of drilling fluid control including a laboratory for pilot testing, mud design procedures and measurement of composition and properties. 1 hr. rec., 3 hr. lab.
240. **Secondary Recovery of Oil by Water Flooding.** II. 3 hr. PR: Pet.E. 232. Theory of immiscible fluid displacement mechanism, evaluation and economics of water flood projects, and oil field flooding techniques. 3 hr. rec.
241. **Petroleum Management Engineering.** II. 4 hr. PR: Pet.E. 106, 232, 235, Econ. 2. Petroleum property evaluation, factors influencing oil economics, values of money and taxation of oil properties. Calculation of reserves and future reservoir performance, decline curves, production and formation testing and special aspects of management of oil and gas properties. 4 hr. rec.
242. **Well Stimulation: Fracturing.** I. 3 hr. PR: Pet.E. 106, 241. Theory of hydraulic fracturing, fracturing tools, fracturing fluids, fracturing orientation; propping agents and general design treatment for optimum profitability. 3 hr. rec.
243. **Advanced Secondary Recovery.** I. 3 hr. PR: Pet.E. 240. Theory and practice of secondary recovery of oil by gas flooding, miscible fluid injection, in situ combustion, and heat injection. 3 hr. rec.
301. **Advanced Petroleum and Natural Gas Engineering Design.** I, II. Credit arranged. Advanced detail design problems in some phase of petroleum and natural gas exploration, production, and transportation, particularly incorporating new ideas, machines and methods.
302. **Fluid Flow in Porous Media.** I. 3 hr. PR: Pet.E. 232 and Math. 140 or consent. Intensive study of theoretical and practical aspects of the physical principles of hydrodynamics in porous media. 3 hr. rec.
397. **Research.** I, II. Credit arranged. An individual research problem in some phase of petroleum and natural gas exploration, production, and transportation. A carefully prepared report is required.

Human Resources and Education

The College of Human Resources and Education includes the Divisions of Clinical Studies, Education, Family Resources, and Social Work, and the Human Resources Research Institute. Established in 1965, the College brings together several disciplines and professions devoted to the study and maximum development of human talent and resources, whether in the context of the school, the family or the community. Programs of instruction, research, and extended service are carried out in each of the divisions of the College and in close cooperation with the related departments and divisions in other sectors of the University.

ADMISSION AND CURRICULUM

It is the responsibility of all applicants to apply for admission to the Graduate School through the Office of Admissions. All candidates for graduate degrees must conform to the general regulations of the Graduate School. Such general regulations and the steps to be followed in the admissions process are covered in Part II of this bulletin. Certain details in regard to admission to specific graduate programs of the College are provided on following pages. Additional information may be obtained by writing to the director of the division in which the graduate program is offered or by writing to the Dean of the College.

The curriculum and degree requirements of the various master's degree programs of the College are shown in each of the respective divisional sections. It is the responsibility of the student to take steps to insure that he is properly informed in regard to the requirements of the degree toward which he aspires and/or the certification standards to which he may wish to conform. Members of the faculty in general, and the student's adviser in particular, will offer counsel to the student on these matters on request.

THE DEGREE OF DOCTOR OF EDUCATION

The Doctor of Education degree is offered with concentration in the Division of Education (curriculum and instruction and educational administration) and the Division of Clinical Studies (including counseling and guidance, reading, speech pathology and audiology, and special education). The Doctor of Education degree is also offered in cooperation with various other schools and colleges of the University.

Admission. Individuals who wish to pursue a program leading to the Doctor of Education degree must be admitted to the Graduate School. All applicants for admission to the doctoral program in the College of Human Resources and Education must submit scores on the Aptitude Test of the Graduate Record Examination and otherwise comply with each of the General Regulations of the Graduate School outlined in Part II and Part III of this bulletin. Acceptance for study toward the doctoral degree in a specific area of concentration will be based on prior academic achievement including a cumulative grade-point average of 3.0 or above and a satisfactory score on the general aptitude test of the Graduate Record Examination or other appropriate measure of academic aptitude and an interview by the Doctoral Admissions Committee during the Preliminary Examination. Students having a cumulative grade-point average of less than 3.0 but having a satisfactory score on the Graduate Record Examination or other appropriate measure of academic aptitude may be admitted provisionally; final acceptance will be contingent upon the results of the Preliminary Examination. Students who meet the standards for admission set forth by the various programs will be assigned a temporary adviser by the Dean of the College of Human Resources and Education.

Preliminary Examination. The student must make application through his temporary adviser to the chairman of Graduate Affairs to take the Preliminary Examination. Usually, the examination is taken after tentative admission to the program and completion of six to twelve hours of doctoral work at West Virginia University. A maximum of eighteen (18) hours credit of doctoral work completed at West Virginia University prior to the preliminary examination may be counted toward the degree.

The purposes of the preliminary examination are to discuss with the student his proposed area of doctoral study, and to make appropriate recommendations to the Dean of the College concerning his acceptance into an area of concentration and acceptability of prior work to meet program requirements.

The composition of the preliminary examining committee shall include, at least, the chairman of graduate affairs, the coordinator of the major program, the coordinator(s) of minor program(s), and the student's temporary adviser. Prior academic achievement, professional experiences, test results, and other evidences of competence in areas essential for successful completion of the Doctor of Education Degree will be taken into consideration.

Doctoral Committee. Having received an affirmative recommendation from the preliminary examination committee to continue doctoral work, a permanent adviser to serve as chairman of the student's doctoral committee and at least four additional committee members will be recommended by the student and approved by the faculty members involved, the director of the appropriate division, and the Dean of the College. At least one member of the doctoral committee must come from a supporting discipline outside the College of Human Resources and Education and no more than three from any single division within the College.

Curriculum. The final determination of the program of course work and research is the responsibility of the student's doctoral committee. The Doctor of Education degree is not awarded on the basis of the completion of any set number of credits but is awarded on the basis of demonstrated academic achievement and scholarly competence. The minimum course work shall be 70 semester hours of graduate work, excluding dissertation credit but including credits of relevant graduate work completed at the master's degree level. A minimum of 24 of the 70 semester hours shall be in the area of major concentration and a minimum of 24 of the 70 semester hours from a minor area of concentration in a supporting or related discipline. At least one-half of the semester hours taken within the College and at least one-third of the hours taken outside the College shall be courses at the doctoral level.

Candidates having previously earned a graduate degree from West Virginia University will be required to earn credit in residence at another graduate institution offering the doctorate in the student's major field. The student's doctoral committee shall approve the institution and the course work. In every case, a minimum of two semesters in residence at West Virginia University as a full-time doctoral student will be required. All of the requirements for the degree shall be completed within a period of seven years.

Admission to Candidacy Examination. The purposes of the admission to candidacy examination are to assess the quality of the student's academic achievement, to review the student's program of course work, to approve a proposed outline of dissertation research, and to admit the student to formal candidacy for the degree.

The examination may be taken after at least two-thirds of the student's program of course work has been completed but prior to the dissertation phase of the program. The admission to candidacy examination consists of two parts: (a) a written examination, and (b) an oral examination. The candidate must pass the written examination prior to taking the oral portion. The written examination will include a common "foundations" section (history and philosophy of education, research design and statistics, social and psychological foundations) and specifically prepared written examinations in the major area of concentration and in the area of concentration in the supporting discipline. The written examination may be repeated one time and, upon consent of the Dean, director of the appropriate division, and the coordinator of major program, may be repeated a second and third time. At least six months must elapse between repeated examinations.

The oral portion of the admission to candidacy examination will be administered by the student's doctoral committee at the call of and under the direction of the committee chairman after successful completion of written portion of examination.

The oral portion of the examination at which time the student must present and defend the prospectus for his doctoral dissertation, may be repeated one time and on recommendation of the doctoral committee, may be repeated a second time. At least six months must elapse between repeated examinations. On successful completion of the admission to candidacy examination, the student will be admitted to formal candidacy for the doctoral degree.

Dissertation. The candidate must submit and justify an outline or a prospectus for his doctoral dissertation at the oral portion of the admission to candidacy examination. The doctoral committee must review and *approve*, *approve with change*, or *reject* this outline or prospectus. The student shall consult with all members of the doctoral committee and with other appropriate members of the University faculty during the dissertation phase of his program.

Final Oral Examination. The student will be admitted to a final oral examination upon completion of his dissertation and after he has fulfilled all other requirements set by his committee. This examination will be conducted by his doctoral committee and will be open to all members of the University faculty. The candidate will not be recommended for the doctoral degree if he receives more than one unfavorable vote from his doctoral committee.

CERTIFICATE OF ADVANCED STUDY

This program is designed to prepare school and related personnel who wish professional training beyond the Master's degree. Candidates for this Certificate may choose from among the following areas of study for their area(s) of concentration: (a) Administration and Supervision; (b) Curriculum and Instruction; (c) Counseling and Guidance, Reading, and Special Education; and (d) Physical Education. Persons interested in this certificate should consult with the director of the appropriate division or the Dean of the College of Human Resources and Education.

Prerequisites for Admission to the Program

1. General requirements for admission to the Graduate School of West Virginia University.
2. A Master's Degree with a grade-point average of 3.0 or higher.
3. A minimum of three years of teaching or closely related educational experience.

Requirements for Admission to Candidacy

1. Evidence through examination, personal letter, and personal interview of general proficiency, acceptable standards of oral written communication, and good health.
2. Satisfactory completion *in residence* at West Virginia University of at least six semester hours of approved course work beyond the conferring of the Master's degree.
3. Students must submit scores on the General Aptitude Test of the Graduate Record Examination.

Requirements for Completion

The Program. An approved program consisting of a minimum of 30 semester hours earned above the Master's degree of which 24 semester hours will be course work in the College of Human Resources and Education or in closely related fields and 6 hours or research.

At least 24 semester hours of the work credited for this Certificate must be done in residence at West Virginia University. This requirement includes the 6 hours of research which may be conducted apart from the physical limits of the University but must be done under the direction and supervision of the chairman of the student's

graduate committee. A maximum of 6 semester hours earned in residence at another approved graduate institution or in West Virginia University Extension may, if approved by the student's adviser, be allowed toward credit for the Certificate. The minimum period of full-time graduate study in residence at West Virginia University is one semester or one full summer session.

Final Examination(s). Upon completion of all requirements including the research report, the candidate will be admitted to a final oral examination by his graduate committee.

Time Limitation. All requirements must be completed within seven years immediately preceding the awarding of the Certificate.

HUMAN RESOURCES RESEARCH INSTITUTE

The Institute is the major research facility of the College of Human Resources and Education. It does not offer a program of studies leading to a degree but provides research support, research consultation, and opportunities for participation in multidisciplinary or programmatic research projects for faculty and graduate students in all divisions of the College as well as the Departments of Psychology and Sociology in the College of Arts and Sciences. Research of a basic, applied, or methodological nature is encouraged and supported by the Institute.

A number of graduate assistantships are available in the Institute. Students admitted to graduate study in any division of the College and in the Departments of Psychology and Sociology are eligible for these assistantships. Inquiries may be directed to the director or to the chairman of the department in which the student is registered.

DIVISION OF CLINICAL STUDIES

The Division of Clinical Studies includes the program of Counseling and Guidance, Reading, Rehabilitation Counseling, Special Education, and Speech Pathology and Audiology. The Division offers three programs leading to the Master of Arts and two programs leading to the Master of Science degree. The degree of Doctor of Education is offered in the areas of Counseling and Guidance, Reading, and Special Education.

The candidates for graduate degrees must meet the general regulations of the Graduate School, the College of Human Resources and Education, and specific regulations as required by the Division programs. Descriptions of the admission, curriculum, and degree requirements are shown in each of the respective program sections.

Requirements for Admission to Graduate Study Leading to the Master's Degree

General Considerations

A person who wishes to pursue a graduate program leading to a degree in the Division of Clinical Studies must meet the general requirements for admission to the Graduate School and the College of Human Resources and Education. Additionally, to be admitted to candidacy for the master's, certificate of advanced study, or doctoral degrees, prospective candidates must meet the appropriate requirements and procedures described herein.

Admission to Graduate Study at the Master's Level

To be admitted to graduate study leading to the master's degree, the applicant must:

1. have attained a 2.5^o undergraduate grade-point average
2. have attained a Verbal score of at least 400 on the General Aptitude Test of the Graduate Record Examination
3. have submitted to the Division Admissions Committee a minimum of three letters of recommendation from previous instructors and/or employers attesting to the applicant's ability to pursue graduate study and potentiality to function in a professional capacity.

Conditional Admission

Applicants who have: (1) attained an undergraduate grade-point average of at least 2.0 but less than 2.5, and/or (2) failed to attain a score of at least 400 on the Verbal section of the General Aptitude Test of the Graduate Record Examination may be admitted conditionally as "Probationary graduate students" in the Division for a period not to exceed the completion of 15 graduate hours, 9 of which must be as a full-time resident student. No later than the end of the semester in which the student completes his 15th hour, he shall be reclassified as a regular graduate student only if he has attained a grade-point average of at least 3.0 computed on all graduate hours attempted. Any student who does not attain a 3.0 average for all graduate hours attempted may not continue further study and is not eligible to receive the Master's degree.

Admission to Candidacy for the Master's Degree

To be admitted to candidacy for the Master's degree in any of the program areas in the Division of Clinical Studies a prospective candidate must:

- (1) be classified as a regular graduate student,
- (2) submit to the appropriate program area a proposed program of study endorsed by his faculty adviser,
- (3) complete the initial program-planning examinations.**

Admission to Candidacy for the Certificate of Advanced Study

The Certificate of Advanced Study (CAS) is regarded primarily as a terminal degree for those qualified individuals who do not plan to pursue the doctorate. As such, it is separate and distinct from the doctoral programs. Therefore, completion of the requirements for the CAS does not necessarily imply that such coursework would be acceptable for a doctoral program should the student subsequently choose to pursue the doctorate.

The broad criteria for the CAS are: an appropriate master's degree or its equivalent with a minimum graduate grade-point average of 3.0. Students interested in the possibility of pursuing the CAS should consult with faculty in the appropriate program areas.

Admission to Graduate Study Leading to the Doctorate

Students interested in pursuing the doctorate are admitted to candidacy in three different phases. The first phase consists of application for admission to the

^oAll grade-point averages discussed refer to a four-point system where 4.0 is an "A".

^{**}The program-planning examinations are *mandatory* during the first semester that students plan graduate study in the Division. Examinations usually are held on the second and third Saturdays following the week classes begin in any given semester. Specific time and location are available in both the registration center and the Division. A student who fails to abide by this regulation shall not, except in the most highly unusual circumstances, be allowed to pursue coursework in the Division that semester. This includes extension coursework and coursework at the Kanawha Valley Graduate Center.

University Graduate School using standard admissions procedures. The second phase consists of the Preliminary Examination and formal admission to doctoral study in the program area of the Division. The third phase consists of the Admission to Candidacy Examination. Details of these major steps are available on page 162 under "The Degree of Doctor of Education."

Special Requirements for the Master's Degree in Counseling and Guidance, Reading, and Special Education

1. No student may be awarded a Master's Degree unless he has a minimum grade-point average of 3.0 on all work taken for graduate credit. (A grade of less than "C" does not carry credit toward a graduate degree, but will be counted in determining the grade-point average.)

2. No student may repeat a required graduate course more than once.

3. Fifteen semester hours of approved work in extension may apply toward the completion of degree requirements, if no work is transferred from another institution.

4. No more than six semester hours of approved transfer credit from another institution may be applied toward the degree.

5. No more than nine hours of extension work may be used toward the degree if six hours of transfer credit from another institution is applied toward the degree.

6. Requirements for the Master's Degree must be completed within a period of seven years.

7. Final examination (oral, written, or both, at the discretion of the candidate's adviser and the department of Counseling and Guidance).

A candidate who fails the final Master's degree examination may be given (upon written consent of his advisory committee) a second examination not earlier than the following term or semester. A candidate who fails the second examination may, upon written request and with the consent of his committee, be given a third and final trial no earlier than one calendar year from the date of his second examination.

COUNSELING AND GUIDANCE

(Master of Arts Degree)

GENERAL REQUIREMENTS

I. Admission to Program

(A). Completed application made first to: Office of Admissions, West Virginia University.

(B). Minimum 2.5 undergraduate grade-point average.

(C). Minimum Graduate Record Aptitude Examination score of 400 (verbal).*

(D). Contact with adviser by mail or conference prior to registration of courses.**

(E). Program Planning Exam must be taken in the first semester after initial registration.

(F). Program planning contract initiated with adviser and department.

Students will not be classified as "regular graduate students" until the above requirements have been completed. Applicants who do not meet the above criteria may petition the Clinical Studies Committee on Admission and Examinations for Probationary Admission. If no more than one course in Counseling and Guidance is taken within two years of admission, the application will be invalidated and the applicant must reapply.

*The 400 Verbal GRE score was required beginning spring semester, 1968.

**The Counseling and Guidance syllabus and program requirements are distributed at this time.

II. Admission to Candidacy

- (A). Completion of requirements within Blocks A and B below.
- (B). Completion of the Master's Candidacy Preliminary Exam which is part of practicum preregistration. Students must make application for the Master's Preliminary Exam during registration or by mid-term prior to the administration of the exam.

III. Master of Arts Degree and Professional Counselor Endorsement and Certification

- (A). Completion of a minimum of 36 hours* from Blocks A, B, and C, *or*
- (B). Completion of 33 hours plus a thesis, in which case only 6 hours from Block B are required.
- (C). A minimum graduate grade-point average of 3.0.**
- (D). Successful completion of the Master's Comprehensive Examination at the close of the practicum, after clearance from the Graduate School.
- (E). Recommendation of the faculty.

Required for West Virginia Certification, not for degree

- (F). A valid professional teaching certificate at the level for which counseling and guidance endorsement is desired.
- (G). Two years of successful educational experience in teaching or guidance and counseling or a combination thereof at the level for which an endorsement for counseling and guidance is desired.

IV. Temporary License in Counseling and Guidance: Guidance Worker***

A teacher wanting a professional certificate may be granted a *temporary license*, valid for one year, endorsed for serving as a COUNSELOR AT THE LEVEL OF HIS PROFESSIONAL CERTIFICATE provided he:

- (A). Secures the recommendation of the superintendent who agrees to employ him.
- (B). Has completed 12 semester hours of graduate credit with at least one course in each of the following areas:
 - a. Principles of Guidance
 - b. Individual Inventory
 - c. Counseling
 - d. At least 3 semester hours in any of the 6 required areas:
 - 1. Principles of Guidance
 - 2. Individual Inventory
 - 3. Counseling
 - 4. Environmental Information
 - 5. Psychology
 - 6. Research
- (C). Submit a plan which has University approval for the completion of the guidance program.
- (D). Recommendation at West Virginia University will be made with completion of the following four courses leading to 12 hours of graduate credit:
 - 1. Basic Course in Guidance
 - 2. Sensitivity to Human Relationships
 - 3. Elementary Statistics
 - 4. Human Appraisal

*While 36 hours represents the minimum academic requirements, proficiency in counseling is the prime criterion for completion of the counseling and guidance program. This may mean that in some cases on the basis of the preliminary exam, practicum performance, and/or comprehensive exam additional course work or experience may be required to meet this level of competency.

Prospective candidates for the Counseling and Guidance program should carefully examine their motives, personal strengths, and weaknesses to determine if limitations in their capacity for intense interpersonal relationships may restrict or impede their acquiring the expected level of counseling proficiency and application of academic and research skills.

**Required for students admitted beginning second semester 1967-68.

***Temporary License in Counseling and Guidance. The temporary license as a Guidance Worker replaces the Counselor Permit as of September 1, 1968.

V. Inclusion of Renewal

The holder of a temporary license endorsed for serving as a counselor may have his license reissued for a one-year period, provided:

- (A). He completes, subsequent to the issuance of his last license, six semester hours of graduate credit in courses prescribed for the counselor endorsement.
- (B). The graduate institution where he expects to complete his counseling program must:
 - a. verify that the credits earned are prescribed by the West Virginia Board of Education for the issuance of this endorsement;
 - b. recommend the reissuance of the license based upon the applicant's satisfactory performance in his specialization.
- (C). The employing superintendent must also:
 - a. certify that the applicant is the best qualified person available;
 - b. recommends the reissuance of the license based upon successful experience.

COURSE REQUIREMENTS

Block A Courses

A-I Counseling and Guidance Foundations: (10 hours)

C&G 302. Sensitivity to Human Relations. 2 hr.

C&G 303. Basic Course in Guidance. 3 hr.

Stat. 211. Elementary Statistics. 3 hr.

C&G 320 (or Rehab. 320). Vocational Development and Occupational Choices. 2 hr.

A-II Behavioral Science Foundations Courses: (9 hours)

Courses may be selected with the consent of the adviser from approved electives in the Psych-Socio foundations listed below to complete the (9) hours required in this block. Courses which will be approved in this block are those external to the C&G department designed to better understand human behavior and to supplement counseling. Demonstration of proficiency in the areas of Personality Theory, Learning Theory, and Research will be required to pass the Master's Preliminary Exam. Credit in research is required for certification.

Personality Theory*

Learning Theory*

Research*

Advanced Educational Psychology

Child Development

The Exceptional Child

Adolescent Development

Social Psychology

Mental Hygiene

Anthropology

Economics

Sociology

Abnormal Psychology

Behavior Problems in the School

Specialized course from area of concentration, one course allowed

Block A-II in conjunction with undergraduate preparation should provide the expected knowledge needed for the Master's Preliminary Exam on personality theories, human growth and behavior, and basic sociological concepts. Skill and knowledge in interpreting research is expected to be developed in each course throughout the sequence. Campbell's *Form and Style in Thesis Writing* will be used as the standard reference of style for preparation of papers; familiarity and competency in its utilization is necessary. The Master's thesis should be prepared under the Graduate School regulations on theses and dissertations.

*Students who may move on into the doctoral program should prepare themselves in depth in these required areas.

Block B Courses: (6 hours) (PR: Second semester status)

B-I Courses

C&G 305. **Theory and Practice of Human Appraisal.** 3 hr. PR: C&G 303 or proficiency exam in Statistics.

C&G 306. **Counseling Theories and Techniques.** 3 hr. PR: 15 hr. completed including Block A-I by completion of C&G 306.

B-II Preliminary Examination

The Master's Candidacy Preliminary Examination which can be taken concurrently with C&G 306 must be taken prior to registration for the practicum. This exam, replacing the objective portion of the Master's Comprehensive Examination, will be held two weeks before the end of each term. Students must register with the departmental secretary by mid-term prior to the exam. This exam covers the foundation material from Personality Theory, Learning Theory, and Research; plus material as indicated by the C&G syllabus which is designed to bring guidance foundation knowledge 302, 303, 304, 305, and 306 to the criterion level expected of all counselors.

Block C Courses: (11 hours)

C&G 307. **Application of Counseling Techniques.*** 3 hr.

C&G 308. **Organization and Development of Counseling and Guidance Services.** 2 hr.

C&G 309. **Group Techniques in Counseling and Guidance.** 2 hr.

C&G 385. **Practicum in Counseling.** 4 hr.

(NOTE: C&G 307-385 will be combined with C&G 308 and 309 in the Summer program for the Practicum Block.)

*C&G 307 should be taken concurrently with C&G 306 by fall term students. Summer students will take C&G 307 with the regular Practicum Block (Block C).

SPECIAL REQUIREMENTS

1. Fifteen semester hours of approved work in Extension may apply toward the completion of degree requirements if no work is transferred from another institution; however, *only* 9 hours of work may be applied from any single departmental or program area.

2. No more than 9 hours may be taken in Extension prior to the completion of 6 hours in residence at the University.

3. No more than 12 semester hours of approved transfer credit from another institution may be applied toward the degree. Transfer course work will be considered from Block A and B excluding 306.

4. No more than 15 hours of combined extension and transfer credit may be used toward the degree.

5. Requirements for the Master's Degree must be completed within a period of seven years.

6. A student admitted on probationary status must achieve a 3.0 grade-point average by the completion of a maximum of 15 semester hours of approved graduate work, 12 hours in residence. If the probationary student has not achieved a grade-point average of 3.0, he shall be reclassified as a special graduate student, not eligible to be awarded a Master's Degree. A grade of less than "C" does not carry credit toward a graduate degree, but will be counted in determining the grade-point average.

7. No student may repeat a required graduate course more than once.

8. At the discretion of the candidate's departmental advisory committee, a final oral exam may be required after the written comprehensive exam.

9. A candidate who fails the final Master's degree examination may, upon written consent of his advisory committee, be given a second examination not earlier than the following term or semester. A candidate who fails the second examination

may, upon written request and with the consent of his committee, be given a third and final trial no earlier than one calendar year from the date of his second examination.

10. Students completing their degree under a previous program must meet with their adviser or departmental adviser as soon as possible and *prior* to the day of registration for their next term to define any necessary revisions. Previously approved work will be credited and the remaining courses must be selected from within the present program offerings.

11. Satisfactory advising cannot be handled at registration time. Students needing advising are requested to make an appointment to meet with their adviser or with the departmental adviser prior to the registration period.

12. Courses are sequenced so that full-time resident students may plan to finish Block B in the fall term and Block C in the spring.

COUNSELING AND GUIDANCE
(Certificate of Advanced Study)

ADMISSIONS

1. Completion of a master's degree in Counseling and Guidance or equivalent comparable to West Virginia University master's degree in Counseling and Guidance with approved practicum experience.

2. A minimum graduate grade-point average of 3.0.

3. A total score of 1000 on the Graduate Record Examination aptitude test.

4. Personal interview with faculty members in Counseling and Guidance.

5. Demonstration of competency in counseling, measurement, statistics, and the guidance function in education as evidenced by references and appropriate examinations.

6. Evidence of successful appropriate work experience.

7. Written justification for choice in area of specialization.

8. Three references for recommendation.

9. Plan of study approved by assigned adviser.

AREAS OF SPECIALIZATION

Elementary School Counseling
Student Personnel Work
Employment Counseling
Pupil Personnel Services

Secondary School Counseling
Correctional Counseling
Research in Counseling

REQUIREMENTS FOR GRADUATION

A. Completion of 36 semester hours of approved graduate work.

B. A minimum grade-point average of 3.2 on all course work attempted under the Certificate of Advanced Study program.

C. Demonstration of competencies as a specialist in their chosen area of specialization.

D. Recommendation of the department.

PROGRAM

1. 12 semester hours core from C&G:

363. Advanced Theories of Counseling. 3 hr.

366. Manpower Utilization and Development. 3 hr.

369. Theory & Practice of Student Appraisal. 3 hr.
385. Practicum: Advanced—Specialized applications of counseling. 3 hr.
2. 12 semester hours selected with adviser's consent in specialty area of advanced courses external to the C&G program area.
3. 6 hours to achieve competencies in consumption and production of field research.
4. 6 hours research problem in area of specialization.

RESIDENCY (Minimum)

- A. 1 semester or 2 summers (12 hr.) on campus.
- B. Program completion of 12 hours extension and transfer, *or* Approved inter-university cooperative program.

COUNSELING AND GUIDANCE

(Doctoral Degree—Ed.D.)

The doctoral degree program in Counseling and Guidance is tailored to individual needs; however, it does require extensive academic and practical work which carries the student beyond the minimum limits established in the college requirements for the Ed.D. degree. The one-year minimum residency requirement and minimum hour requirements are typically insufficient to master the competencies in knowledge, application of techniques, and research skills. Contact with the program area should be initiated before formal application.

As in the master's degree and certificate of advanced study programs, students may concentrate their program of study in the general area of student personnel work in higher education. Appropriate course work specifically geared to the field is available in the program area, in the Division of Education, and in the College of Commerce.

Counseling and Guidance

216. **Behavior Problems and the School.** I, II, S. 3 hr. Emphasis on the identification and understanding of students with special needs in the areas of social, emotional, and learning problems and in developing remedial programs for these students leading to more satisfactory adjustment within the school situation.
283. **Workshop in Counseling and Guidance.** I, II, S. 1-12 hr. PR: Consent. To take care of credits for special workshops and short intensive limit courses on methods, supervision and other special topics.
302. **Human Relationships.** I, II, S. 2-3 hr. Didactic content and field experience in group processes providing self-screening for prospective counselors. One-half time devoted to class discussion and one-half to small sensitivity groups.
303. **Basic Course in Guidance.** I, II, S. 3 hr. An overview of a total guidance program covering the philosophical, sociological, and psychological foundations of a counseling program.
305. **Theory and Practice of Human Appraisal.** I, II, S. 3 hr. PR: C&G 303 and consent. Comprehensive study of all objective measures used in schools; techniques of administering and interpreting to individual and groups; developing testing programs and costs.
306. **Counseling Theory and Techniques.** I, II, S. 3 hr. PR: C&G 303, 305, 320. Analytical consideration of identifying causes and development of psychological maladjustment. Seminar study of counseling techniques with practice under supervision.

307. **Application of Counseling Techniques.** I, II, S. 3 hr. PR: C&G 303, 305, 306, 320. Clinical consideration of identification, causes and development of psychological maladjustments, further study of developments in counseling and background in advanced studies in guidance.
308. **Organization and Development of Counseling and Guidance Services.** II, S. 2 hr. PR: C&G 303, 305, 306, 320. Operation of guidance program in terms of personal functions, relationships, physical facilities, instructional integration, financial standards, law and regulations.
309. **Group Counseling Theory and Techniques.** II, S. 2-3 hr. PR: C&G 306. A comprehensive coverage of theories of group counseling and demonstrations of specific group techniques for advanced Master's and Certificate of Advanced Studies candidates in Counseling and Guidance.
- 320. (or Rehab. 320). **Vocational Development and Occupational Choices.** I, II, S. 2 hr. PR: C&G 303. Methods of gathering and disseminating occupational and educational information.
330. **Elementary School Guidance.** I, S. 3 hr. PR: Consent. Practical application of the principles of guidance to the elementary school.
331. **Practice of Elementary School Counseling and Guidance.** I, II, S. 4 hr. PR: C&G 330 and consent. A specialized multiple training experience covering advanced theory, techniques and practices, skill development in teacher consulting, analysis of classroom climate, and competence to deal with the typical problems encountered by the counselor in the elementary school.
- 363. **Advanced Theories of Counseling.** I, S. 3 hr. PR: Practicum in counseling, admission to advanced study, and consent. A comprehensive study of the theoretical issues in contemporary counseling.
364. **Individual Intelligence Testing and Interpretation.** I. 4 hr. PR: Advanced standing and preregistration with instructor (9 hr. psychology and demonstration of proficiency in measurement needed for admission). Techniques in administering, scoring, and interpreting individual mental ability tests.
366. **Manpower Utilization and Development.** II. 3 hr. PR: Advanced standing and consent. A consideration of the economic, social, and political implications of manpower utilization and the role the counselor must undertake to assist society with its ever pressing demands.
- 369. **Advanced Theory and Practice of Human Appraisal.** II, S. 3 hr. PR: Statistics 211, C&G 375, and consent. Analysis of and supervised practice in the use of major standardized and local assessment instruments typically used in vocational and educational guidance and counseling. Included also are factors in the management and development of coherent testing programs.
370. **Introduction to Student Personnel Work in Higher Education.** I. 3 hr. PR: Consent. A historical and topical study of the development of student personnel structure and functions in higher education, including an examination of goals and objectives in light of current social forces and relevant research.
372. **Internship in Student Personnel Work.** I, II. 1-12 hr. PR: Admission to Certificate of Advanced Studies in Doctoral program in Counseling and Guidance. The course is designed to offer advanced graduate students an opportunity to practice under close supervision the professional skills required in the broad field of student personnel work in higher education.
380. **Seminar.** I, II, S. 1-6 hr. PR: Advanced standing and consent. Seminar for Certificate of Advanced Studies and doctoral students in Counseling and Guidance.
382. **Special Topics.** I, II, S. 1-6 hr. PR: Advanced standing and consent. Independent study and directed readings in specialized areas of counseling and guidance.

385. **Practicum.** I, II, S. 1-12 hr. PR: Preregistration, cleared for graduation at close of term, or M.A. degree. An intensive supervised practical experience in the public schools in counseling with individual critique and appropriate small group experiences.
395. **Problem in Counseling and Guidance.** I, II, S. 1-12 hr. PR: Consent. Research for master's degree in Counseling and Guidance.
397. **Research.** I, II, S. 1-15 hr. PR: Consent. Research for the program leading to the Certificate of Advanced Study in Counseling and Guidance.

READING

Curriculum for Classroom Teachers—Reading

Degree: Master of Arts

I. <i>Required Courses</i>	Program A	B
Ed. 271*	3	3
Ed. 301	3	0
Ed. 337	0	3
Ed. 270*	0	3
Rdng. 276* or 277*	3	3
Rdng. 300*	3	3
Rdng. 304*	3	3
Rdng. 306*	3	3
Rdng. 394	3	0
	<hr/> 21	<hr/> 21
II. <i>Electives</i>	9	15
Rdng. 283, 301, 302, 315, 316, 320,* 380		
Psych. 243,* 261, 263,* 264, 281, 282, and 323		
Ed. 221 and 346		
C&G 216, 302, 305, 303 and 313		
SPA 250 or 275		
Sp. Ed. 255, 260, 306, and 380		
Total	<hr/> 30	<hr/> 36

Completion of this curriculum fulfills the scholastic requirements for a Master's Degree in Reading at West Virginia University.

Requirements for a Specialized Certificate in Reading in West Virginia are:

- (1) a Master's Degree in Reading including all courses in the above curriculums marked with an asterisk, (2) a five-year professional certificate for teaching, and (3) three years of successful experience as a classroom teacher.

*Courses marked with an asterisk are required for a reading endorsement. They can be replaced by a transfer or substitute course only by written permission from the adviser.

Reading

276. **Reading for Classroom Teachers.** I, II, S. 3 hr. PR: Consent. A basic course in teaching reading, grades 1-12, planned to give students who have little or no background in reading an opportunity to study the reading process and to learn how to apply effective techniques and methods to classroom teaching of reading.
277. **Reading Instruction in the Secondary Schools.** I, II, S. 3 hr. PR: Consent. A study of the reading skills essential at the high school level and how they may be developed in the various subject matter areas.

283. **Workshop in Reading.** I, II, S. 1-6 hr. A course designed for in-service training of teachers—both elementary and secondary. Regularly offered as an extension course, the chief emphasis is upon the organization of reading programs in the elementary and secondary schools.
300. **Foundations of Reading Instruction.** I, S. 3 hr. A course which is principally concerned with the physiological, psychological, and sociological factors underlying the development of reading skills. The course is intended for majors in education, reading, guidance, special education, speech, and other areas whose specialities require an understanding of the reading process.
301. **Teaching the Language Arts.** I, S. 3 hr. PR: Consent. A study of the interrelationship among the different phases of the language arts. Special attention is given to organizing the language arts program, selecting materials and equipment, and understanding effective techniques and methods for teaching, listening, oral language, written language, handwriting, and spelling.
302. **Selection and Evaluation of Reading Materials.** I, S. 3 hr. PR: Consent. A survey of critical reading skills, techniques, and procedures with emphasis on the selection of supplementary materials needed for effective developmental and remedial reading programs.
304. **Corrective Techniques in Reading Instruction.** II, S. 3 hr. PR: Rdng. 276, 277, or 300. A basic course in corrective reading for classroom teachers. Special emphasis is given to the correction of reading difficulties by classroom teachers with equipment and materials available to the average classroom.
306. **Problems in Clinical Reading.** I, II, S. 3 hr. PR: Rdng. 304. A laboratory course in remedial reading. Major emphasis will be placed upon tutoring remedial cases in the Reading Center.
315. **Survey of Major Problems in Reading.** II, S. 3 hr. PR: Rdng. 276, 277, or 300. An advanced course in the major problems confronting the teacher or supervisor of reading instruction. Essentially a research course in which each student will have the opportunity to complete an individual problem in an area of special interest.
316. **Survey of Major Problems in the Language Arts.** II, S. 3 hr. PR: Rdng. 301 or consent. An advanced course covering the major problems confronting the teacher or supervisor of language arts instruction. Essentially a research course in which each student will complete an individual problem in an area of special interest.
320. **Organizing the Reading Program.** I, S. 3 hr. Stresses current practices and procedures in organizing reading programs in all types of schools, grade one through college.
375. **Diagnosis of Reading Difficulties.** I, S. 3 hr. PR: Rdng. 304. Advanced instruction in diagnosis. Emphasis will be placed upon the use of standardized tests, informal tests, machines, and observation in determining the cause of reading difficulties.
376. **Correction of Reading Difficulties.** II, S. 3 hr. PR: Rdng. 375 or consent. Advanced instruction in the correction of reading difficulties. Major emphasis will be placed upon methods of teaching, the use of machines and commercial materials, constructing and using teacher-made exercises, and evaluating progress.
378. **Advanced Clinical Reading.** I, II, S. 3 hr. PR: Rdng. 306. An advanced laboratory course in remedial reading. Major emphasis will be placed upon the diagnosis and treatment of reading difficulties caused by specific learning disabilities.
380. **Seminar.** I, II, S. 1-6 hr. PR: Consent. A seminar stressing the interrelationships among the language arts; mental, physical, and psychological deterrents to language development; needed research in language arts; and similar topics.

381. **Special Topics.** I, II, S. 1-6 hr. PR: Admission to the doctoral program in reading and consent. An advanced seminar for doctoral students. Considers the weaknesses and strengths in current reading programs, needed research in reading, and suggestions for improving reading instruction at the elementary, secondary, and college levels.
385. **Practicum.** I, II, S. 1-12 hr. PR: Consent. Stresses practical application of reading theory to organizing and conducting developmental and remedial reading programs.
394. **Problem in Reading.** I, II, S. 3 hr. Research for Master's degree in Reading.
397. **Research.** I, II, S. 1-12 hr. Research for the Master's degree or Certificate of Advanced Study in Reading.

REHABILITATION COUNSELING

The program in Rehabilitation Counseling offers a graduate curriculum designed to prepare professional counselors to work in a wide variety of rehabilitation settings, including public and private rehabilitation agencies, rehabilitation centers, sheltered workshops, hospitals, and similar facilities. The program prepares the counselor to contribute effectively as a member of a professional team through his understanding of human behavior, his knowledge of rehabilitation concepts, his utilization of effective counseling, and a knowledge and application of rehabilitation evaluation techniques. The counselor must also have developed skill in coordinating services to meet the needs of handicapped persons.

ADMISSION

The applicant must meet admission requirements of the Graduate School and the Program Admissions Committee. A broad liberal arts background is preferable; however, an applicant must have earned a minimum of 6-9 semester hours in courses related to the dynamics of human behavior as a prerequisite to unconditional acceptance as a full-time degree candidate. In addition, each applicant must successfully complete personal interviews with the program faculty and achieve acceptable scores on the program entrance examination.

REQUIREMENTS FOR COMPLETION

The degree of Master of Science with a major in Rehabilitation Counseling is conferred by the University upon those students who satisfactorily complete the requirements established by the Graduate School, including the following requirements:

1. Completion of graduate courses approved by the Rehabilitation Counseling Program totaling no fewer than 42 semester hours with a 3.0 grade point average. In most cases, the total program will range between 42 and 48 semester hours.

2. Completion of 10 to 12 semester hours of supervised clinical practice under faculty direction in a rehabilitation setting.

3. Demonstration of competence in the theoretical and applied aspects of rehabilitation counseling to the satisfaction of the Faculty Committee in charge of the Program. This will include passing a comprehensive examination, oral, written, or both, at the discretion of the Committee. A project will be required. A degree will not be awarded solely on the basis of credits earned. A candidate must also demonstrate, as he proceeds in the program, the ability to assume the degree of responsibility required of a professional counselor, and the personal characteristics essential to effective working relationships with others.

CURRICULUM FOR REHABILITATION COUNSELING

The choice of courses comprising the program will be determined by an evaluation of the needs of the individual student. The student's program is then supplemented by other courses offered in Rehabilitation or by appropriate electives selected from other programs and departments. In all cases, courses are selected by the student with the consent of his adviser.

Rehabilitation Counseling

- 200. **Introduction to Rehabilitation Services.** I, II. 2 hr. PR: Junior standing and 15 hr. in social science or education or consent. A study of the processes by which certain human conditions may be ameliorated by social and vocational rehabilitation services, in particular, counseling and evaluation. Emphasis upon historical survey, philosophy and concepts of rehabilitation and case service techniques to assist individuals with physical, mental, and/or social handicaps.
- 210. **Medical Aspects of Rehabilitation.** I, II. 3 hr. PR: Junior standing and 15 hours in social science or education or consent. A study of the medical needs of handicapped persons in the rehabilitation process from time of referral through placement and case closure.
- 274. **Field Work in Rehabilitation.** I, II, S. 1-6 hr. PR: Consent. Supervised field work experience in rehabilitation settings to provide rehabilitation counseling students with a more adequate orientation to their profession.
- 312. **Psychological Aspects of Disability.** I, II. 3 hr. PR: Graduate standing and consent. A study of the psychodynamics of adjustment to atypical physique and prolonged infirmity. Includes a study of somatopsychology.
- 314. **Special Problems in Rehabilitation.** I, II. 1-3 hr. PR: Graduate standing and consent. Rehabilitation theory and techniques in problems such as blindness, epilepsy, and mental retardation. Course also provides for concentrated study in special institutes.
- 320. **Vocational Development and Occupational Choices.** I, II. 3 hr. PR: Graduate standing in social sciences or education. A study of vocational development theory, occupational choice, problems of maturation and work attitudes, techniques of job evaluation, and socio-economic implications of a changing occupational structure.
- 362. **Clinical Conference in Rehabilitation.** I, II, S. 3 hr. PR: Graduate standing and consent. An analysis and integration of the clinical methods essential to facilitating the rehabilitation process.
- 372. **Counseling Practicum.** I, II. 3 hr. PR: Graduate standing and consent. Supervised experience in the application of counseling techniques in the rehabilitation process.
- 375. **Clinical Practice.** I, II, S. 1-12 hr. PR: Consent, following at least one academic semester in classroom. Clinical practice (internship) in selected agencies, rehabilitation centers, clinics, or hospitals conducting an organized program of services for the physically, mentally, emotionally, or socially handicapped. Such practice will be under direct supervision of faculty and agency personnel.
- 380. **Seminar.** I, II, S. 1-12 hr. PR: Consent. Administration of programmatic research; legal and ethical issues in research and service programs, etc.
- 381. **Special Topics.** I, II, S. 1-6 hr. PR: Consent. Contemporary issues in the behavioral sciences and rehabilitation.
- 382. **Workshop in Rehabilitation.** I, II, S. 1-12 hr. PR: Consent. Supervision in the counseling process; vocational evaluation in rehabilitation; utilization of rehabilitation research; contemporary issues in rehabilitation.
- 391. **Directed Study and Research.** I, II, S. 1-3 hr. PR: Consent. Directed reading and/or research in special rehabilitation areas.

SPECIAL EDUCATION

Curriculum for Special Education

Degree: Master of Arts

I. Required Courses	Program ¹ A	B	C
Sp. Ed. 250	3	3	3
Sp. Ed. 255	3	3	3
Sp. Ed. 260	3	3	3
Sp. Ed. 265	0	0	3
Sp. Ed. 305	3	3	3
Sp. Ed. 306	3	3	3
Sp. Ed. 387	3	3	3
Sp. Ed. 395	0	3	0
Sp. Ed. 397	6	0	0
C&G 305	3	3	3
Ed. 301	3	3	0
Psych. 281	0	3	3
Total	30	30	27

II. Approved Electives	Program A	B	C
C&G 303, 306, 330, 364, 366.	6	6	9
Ed. 221, 271, 301, 308, 317, 331, 335, 336, 348, 349.			
Psych. 263, 264, 271, 282, 323.			
R.C. 388.			
Rdng. 276, 300, 304, 315.			
SPA 250.			
Sp. Ed. 262, 271, 281, 365, 380, 381, 387, 397.			
Total for Master's Degree	36	36	36

¹A—Thesis Program

B—Problem Program

C—36-Semester Hour Program

Special Education

250. **Survey of Exceptional Children and Adults.** I, II, S. 3 hr. PR: Consent. Introduction to all areas of exceptionality. Topics surveyed include definition, psychological and educational characteristics, and social and vocational adjustment.
255. **Introduction to Mental Retardation.** I, II, S. 3 hr. PR: Consent. Consideration of historical, etiological, social, educational, and vocational aspects of mental retardation.
260. **Curriculum and Methods for the Educable Mentally Retarded.** I, II, S. 3 hr. PR: Sp. Ed. 250, 255 and/or consent. Organization of instruction, adaptation of teaching methods in the several curricula areas and the construction of materials.
262. **Curriculum and Methods for the Trainable Mentally Retarded.** I, II, S. 3 hr. PR: Sp. Ed. 250, 255 and/or consent. Analysis of special problems of curriculum development for the trainable child and adult and provisions for development of original construction of curricula materials.
265. **Industrial Arts in Special Education.** II, S. 3 hr. Experimentation with industrial arts and crafts suitable for instruction in special education classes. Discussion of factors involved in selection and manipulation of such media as leather, plastics, ceramics, wood, and metal.

271. **Curriculum, Materials, and Methods for Mentally Gifted.** I, II, S. 3 hr. History and philosophy, identification, curriculum, materials and methods of working with mentally gifted.
280. **Student Teaching Clinical Experience in Special Education.** I, II, S. 1-6 hr. PR: Consent. Student teaching with the mentally retarded.
281. **Special Problems and Workshop in Special Education.** I, II, S. 2-4 hr. PR: Consent. To take care of credits for special workshops and short intensive unit course on methods, supervision, and other special topics.
305. **Mathematics for the Mentally Retarded.** I, S. 3 hr. PR: Consent. Materials and methods for teaching mathematics to the mentally retarded child.
306. **Reading for Mentally Retarded Children.** I, S. 3 hr. Designed especially for majors in Special Education. Emphasizes the techniques, methods, and materials most effective for teaching reading to mentally retarded.
365. **Administration and Supervision of Programs for Exceptional Children.** I, II, S. 3 hr. PR: Consent. Administration and supervision with attention to: selection and placement procedures; facilities and equipment; local, state, federal legislation; and philosophy and recent research.
380. **Seminar.** I, II, S. 1-6 hr. PR: Consent. Special topics concerned with the educational, sociological, and psychological aspects of mental retardation.
381. **Special Topics.** I, II, S. 1-6 hr. PR: Consent. Special topics or research in mental retardation and in exceptional children and adults.
387. **Practicum.** I, II, S. 1-12 hr. PR: Consent. Internship, advanced student teaching, and administration and supervision practicum.
395. **Problem in Special Education.** I, II, S. 3 hr. Research for Master's Degree in Special Education.
396. **Project in Special Education.** I, II, S. 3-6 hr. Research for the program leading to the Certificate of Advanced Study in Special Education.
397. **Research.** I, II, S. 1-15 hr. Research in Special Education.

SPEECH PATHOLOGY AND AUDIOLOGY

Master of Science in Speech Pathology and Audiology

Persons who possess a Bachelor's degree from an accredited college or university may be admitted to a program leading to candidacy for the degree of Master of Science in Speech Pathology and Audiology, provided that they: (1) present evidence of ability to pursue graduate work successfully as measured by the Graduate School standards for admission, and additional divisional and academic area requirements, (2) provide evidence, through written recommendations or successful professional experience, of the personal qualities predictive of professional success, and (3) show adequate academic preparation in the basic and background courses in speech and hearing science and appropriate physical and social sciences. Any deficiencies in undergraduate preparation will be made up either without credit or added to the credit required for the degree.

Divisional requirements for the achievement of the Master of Science degree are:

1. Completion of a minimum of 33 semester hours of approved graduate courses in speech science, speech pathology and audiology, and such others in related areas as may be required to attain professional competence, achieving not less than a "B" average for all courses taken for credit toward the graduate degree.
2. Fulfillment of one of the two following alternatives:
 - a. Submission of an approved thesis or problem report for which up to 6 semester hours of credit may be given, or
 - b. Successful completion of an additional 6 semester hours of 300 level courses to fulfill the 33 semester hour minimum requirement.

3. Successful passage of written and oral final comprehensive examinations according to Graduate School and Divisional standards and procedures.

4. Demonstration of professional competence in clinical speech and/or hearing as measured by fulfillment of the academic and practical requirements required for existing certification standards.

Doctor of Education in Speech Pathology and Audiology

(Placed under temporary moratorium by the Program Faculty for an indefinite period effective January 1, 1968.)

The degree of Doctor of Education is offered. For the prerequisites to admission, conditions for admission to candidacy, and general requirements for the degree, see the description of degree requirements in the Division of Education section.

In order to fulfill the specific requirements of the doctoral degree with an academic concentration in speech pathology and audiology, the candidate must possess the personal and professional qualification predictive of potential success in a clinical and scientific field.

The choice of courses comprising the program will be determined by an evaluation of the needs of the individual student. However, at least one-half of the courses above the Bachelor's degree will be chosen from the specialized offerings in speech pathology and audiology. The remainder will be chosen from education, psychology, and such other areas as may be approved by the candidate's committee as related and appropriate.

Candidates having an earlier graduate degree from West Virginia University will be required to complete a prescribed minimum of resident graduate work in one or more other institutions.

Speech Pathology and Audiology

- 220. **Introduction to Audiology. I.** 4 hr. PR: Consent. A study of the gross anatomy and physiology of the auditory mechanism; the physics of acoustic signal production; and an introduction to basic audiometric techniques and interpretation.
- 222. **Hearing Conservation. I.** 2 hr. PR: SPA 220 or consent. An investigation of trauma (varied) or auditory sensitivity and acuity; identification audiometry; and approaches to hearing conservation.
- 223. **Aural Rehabilitation. II.** 3 hr. PR: SPA 220 or consent. A survey of the rehabilitation approaches to management in the auditorially handicapped individual. The medical, audiological and social aspects of rehabilitation will be stressed. Procedures of speech reading and auditory training will be examined and evaluated.
- 250. **Survey of Oral Communication Disorders. II.** 3 hr. PR: Consent. A survey of basic concepts and principles of the disorders of speech and their treatment. Students observe examination and corrective methods of therapists in the clinic and schools. Normal speech and hearing development of children is considered. This is an orientation course for students majoring in speech as well as teachers, school administrators, psychologists, and rehabilitation workers.
- 251. **Advanced Speech Correction. II.** 3 hr. PR: SPA 156. Study of the speech-retarded child and organically based speech disorders including cleft palate, cerebral palsy, esophageal speech, and phonation.
- 252. **Stuttering. I.** 3 hr. PR: SPA 156. Theories and therapies of stuttering.
- 253. **Profound Organic Speech Disorders. II.** 3 hr. PR: SPA 251 or consent. Speech and language disorders related to cerebral injury. Emphasis on aphasia and aphasia therapeutics. Differential diagnosis of children with delayed speech and language.

282. **Clinical Practice in Speech.** I, II. 1-6 hr. PR: Consent. Supervised diagnosis and therapy of speech disorders. (May be taken for a maximum of 3 semester hours per semester of undergraduate or graduate credit.)
283. **Clinical Practice in Hearing.** I, II. 1-6 hr. PR: Consent. Supervised diagnosis and therapy of hearing disorders. (May be taken for a maximum of 3 semester hours per semester of undergraduate or graduate credit.)
321. **Structure and Function of the Auditory System.** I. 3 hr. PR: Consent. A detailed study of the gross and microscopic anatomy of the auditory system, and a detailed investigation of the physiological aspects of auditory sensitivity and acuity.
322. **Audiology and Audiometry.** I. 3 hr. PR: SPA 220 or equiv. A study of the various audiological techniques that are utilized in the differential diagnosis of auditory dysfunctioning. Administration and interpretation of diagnostic techniques.
323. **Bone Conduction Audiometry.** II. 3 hr. PR: SPA 321, 322. An advanced consideration of the anatomical and physiological mechanisms involved in the transmission of acoustic signals through the skull, and the audiological problems in clinical bone conduction audiometry.
324. **Speech Audiometry.** I. 3 hr. PR: SPA 321, 322. The basis for the application of hearing for speech tests in assessing communication systems. Analysis of auditory processing of complex signals and the role of complex signal processing in the differential diagnosis of auditory dysfunction.
325. **Hearing Aids.** II. 3 hr. PR: SPA 322. Principles of the electronic design of amplification systems and acoustic analysis of amplification systems. Hearing aid evaluation procedures.
328. **Clinical Administration Audiology.** I. 3 hr. PR: Consent. The examination of the procedures for initiating and maintaining audiological services in the medical, public school, and community clinical environments.
329. **Acoustic Instrumentation.** II. 3 hr. PR: SPA 158, 322. Principles of electronic design utilized in clinical auditory testing and amplification. Evaluation and assessment of hearing aids in aural rehabilitation.
340. **Experimental Phonetics.** II. 3 hr. PR: SPA 153 and consent. Investigation of problems of phonetics as they are related to functional speech. Instruments used in sound analysis and an investigation of various aspects of architectural acoustics.
341. **Problems in Speech Pathology.** I. 3 hr. PR: Consent. The speech pathologist as a diagnostician and therapist in interdisciplinary investigations. Examination of counseling procedures, administrative practices in varied settings, and organization of programs for various pathologies of speech.
342. **Advanced Speech Pathology.** II. 3 hr. PR: SPA 251 and consent. Theories of causation and therapies for delayed language development, cleft palate, and cerebral palsy.
343. **Neuropathologies of Speech and Language.** I. 3 hr. PR: SPA 154, 253, or consent. Speech and language disturbances related to brain injury or maldevelopment. Consideration of the neurological bases, pathologies and psychological factors involved in the loss or lack of development of speech and language.
380. **Seminar: Audiology.** I. 1-6 hr. PR: SPA 158, 322. Topics vary from term to term to meet student needs. Suggested topics: aural rehabilitation, medical audiology, audiological research, etc.
383. **Clinical Practice in Audiology.** I, II. 1-6 hr. PR: SPA 220 or equiv. and SPA 383 may be taken in conjunction with SPA 322. Supervised experience in the administration and interpretation of audiological evaluative procedures, and application of therapeutic techniques in aural rehabilitation.

387. **Special Topics.** I, II. 1-6 hr. PR: Consent. Open to graduate students in speech pathology and audiology who are pursuing independent problems in that field. May be repeated.
399. **Research.** I, II. 1-15 hr.

DIVISION OF EDUCATION

The Division of Education is comprised of resident courses of instruction and facilities for research; University High School with its opportunities for observing, student teaching, directed supervision, and experimentation; and cooperating elementary and secondary schools for supervised student-teaching experience.

Programs are accredited by the National Council for Accreditation of Teacher Education for the preparation of elementary teachers, secondary teachers, school service personnel, and school administrators, with the Doctor's degree as the highest degree approved.

MASTER OF ARTS

Requirements for Admission to Graduate Work in Education

It is the responsibility of all applicants for admission and all candidates for graduate degrees and certificates to conform to the general regulations of the Graduate School.

Requirements for Admission to Candidacy for the Master's Degree in Education

Graduate students apply to the Office of Admissions for admission. Scores on the Aptitude Test of the Graduate Record Examination should accompany the application but must, in all cases, be submitted to the Division of Education prior to completion of the first 15 semester hours of graduate study. Students may take no more than 9 semester hours in extension prior to completion of at least 6 semester hours in residence. Conditions of Admission to the master's degree program in education follow.

For admission to candidacy for the Master's Degree in Education, students must have a professional teaching certificate based upon an approved teacher education program or at least 20 semester hours of approved undergraduate credit in education.

Students may be admitted as degree candidates on submission of a minimum composite score of 950 on the Aptitude Test of the Graduate Record Examination, or an undergraduate grade-point average of 2.5 (based on a 4.0-point system). These students may pursue the program of their choice immediately.

Students who do not meet either of the above admission requirements may take a maximum of 15 semester hours of course work. At the end of this period students may apply to the Committee on Admissions for review of their admissions classification. Re-classification will be considered *only* in cases in which the student has achieved a *minimum* grade-point average of 3.0 for the first 15 semester hours of graduate study. All work taken up to the conclusion of the term in which the fifteenth semester hour is earned will be used in computing the grade-point average. If the student is not re-classified to degree program status by the Committee on Admissions, he is not eligible to continue graduate study in the Division of Education. He may, upon petition to the Director of the Division of Education, be permitted to take additional course work for the renewal of his teaching certificate.

Optional Routes Towards a Master's Degree in Education

A. Thirty semester hours, including 6 semester hours of research (Ed. 361, Thesis). Examination (oral, written, or both, at the discretion of the candidate's advisory committee.);

B. Thirty semester hours, including 3 semester hours of research (Ed. 360, Problem), selected in conference with the candidate's committee, directed by the adviser, with final approval by the committee and 27 semester hours of course work. Examination (oral, written, or both, at the discretion of the candidate's advisory committee.);

C. Thirty-six semester hours, including 15 semester hours of course work. Examination (oral, written, or both, at the discretion of the candidate's advisory committee.); and

D. Program options D and E are offered in several programs.

Special Requirements for the Master's Degree in Education

1. No student may be awarded a Master's degree in Education unless the student has a minimum grade-point average of 2.5 on all work taken for graduate credit. (A grade of less than "C" does not carry credit toward a graduate degree, but will be counted in determining the grade-point average.)

2. No student will be permitted to repeat a required graduate course more than once.

3. Fifteen semester hours of approved courses in extension may apply toward the completion of degree requirements, if no work is transferred from another institution. A maximum of 12 hours of approved extension courses may be used for certification.

4. The maximum number of hours which may be used from extension courses and transfer credit combined is 15.

5. Students are limited to earning 9 hours in any one field in extension.

7. Students must submit an application to take the final Master's degree examination within the first week of the summer term or two weeks of the semester in which they intend to take it. All applications should be submitted to the student's records adviser.

NOTE: All persons working toward administrative certificates in Education or who wish to add additional administrative certification shall be required to pass a screening examination.

NOTE: A candidate who fails the final Master's degree examination may, upon written consent of his advisory committee, be given a second examination not earlier than the following term or semester. A candidate who fails the second examination may, upon written request and with the unanimous consent of his committee, be given a third and final trial no earlier than one calendar year from the date of his second examination.

GRADUATE PROFESSIONAL EDUCATION CURRICULA

Graduate Professional Education Curricula are offered in three major areas within the Division:

I. *Administration*

Elementary School Principals
Secondary School Principals
Superintendents

II. *Curriculum and Instruction*

Elementary-School Classroom Teachers
Industrial Arts Teachers
Secondary-School Classroom Teachers
Supervisors of Instruction
Teacher Librarians

III. *Health Education*

The administrative certificates issued by the State Department of Education for superintendents, principals (elementary and secondary) and supervisors are called Professional Administrative Certificates.

Curriculum for School Superintendents

Degree: Certificate of Advanced Study

*Required Courses**

Ed. 211, 301	6
Ed. 331	3
Ed. 335, 336	6
Ed. 339	3
Ed. 340	3
Ed. 341	2
Ed. 342	3
Ed. 344	2
Ed. 346	3
Ed. 348 or 349	3
Ed. 362	3-6

Other Certification Requirements

- Applicant must hold a permanent Professional Certificate for teaching.
- Applicant must have completed 8 years of experience in the public schools which shall include at least 3 years as a classroom teacher and 3 years as a school superintendent or assistant superintendent.
- Applicant must secure a physician's statement of satisfactory health.
- Applicant must complete requirements for a Certificate of Advanced Study.

Curriculum for Secondary School Principals

Degree: Master of Arts

I. <i>Required Courses</i>	Program	A ¹	B ¹	C ¹	D ¹
Ed. 211, 301		6	6	6	6
Ed. 331		3	3	3	3
Ed. 336		3	3	3	3
Ed. 339		3	3	3	3
Ed. 346		0*	0*	3	0*
Ed. 348 or 349		0*	0*	3	3
Ed. 353		3	3	3	3
Ed. 360		0	3	0	0
Ed. 361		6	0	0	0
C&G 303		3	3	0	3
II. <i>Internship</i>					
Ed. 327		3	3	0	3
Ed. 328, 338		0	0	0	4
III. <i>Academic Courses Approved by Adviser</i>		0	3	12	5
Total		30	30	36	36

Other Certification Requirements

- Applicant must hold Professional Certificate for grades 7-12.
- Applicant must have had 3 years of successful teaching experience in grades 7-12 and 3 years as a secondary principal or assistant principal.
- Applicant must hold a Master's degree from an accredited institution.
- Educ. 346 and 348 or 349.

A¹—Thesis Program

B¹—Problem Program

C¹—36 Semester Hour Program

D¹—Internship Program

*The courses indicated are those which are necessary to meet certification regulations; some of these will already have been completed as part of another graduate program and will not have to be repeated. Additional information is to be found in the section dealing with the Certificate of Advanced Study.

Curriculum for Elementary School Principals

Degree: Master of Arts

I. Required Courses	Program	A ¹	B ¹	C ¹	D ¹
Ed. 211, 301		6	6	6	6
Ed. 331		3	3	3	3
Ed. 335		3	3	3	3
Ed. 339		3	3	3	3
Ed. 346		3	3	3	3
Ed. 348 or 349		3	3	3	3
Ed. 356		3	3	3	3
Ed. 360		0	3	0	0
Ed. 361		6	0	0	0
II. Internship					
Ed. 315, 325, 326		0	0	0	0
III. Academic Courses Approved by Adviser		0	0	12	6
Total		30	30	36	36

Other Certification Requirements

- Applicant must hold a permanent Professional Certificate for teaching in a self-contained classroom.
- Applicant must have had 3 years experience as a classroom teacher in grades 1-9 and 3 years as an elementary or junior high school principal or assistant principal.

Curriculum for General Supervisors of Instruction

Degree: Master of Arts

I. Required Courses	Program	A ¹	B ¹	C ¹	D ¹
Ed. 211, 301		6	6	6	6
Ed. 306 or 367		0	0	3	0
Ed. 307		0	0	3	0
Ed. 308 and Reading 300, 301 or 305		0	0	6	0
Ed. 331		3	3	3	•
Ed. 335		3	3	3	3
Ed. 339		3	3	3	3
Ed. 346		3	3	3	3
Ed. 348 or 349		3	3	3	3
Ed. 360		0	3	0	0
Ed. 361		6	0	0	0
C&G 303		3	3	3	•
II. Internship					
Ed. 380, 381, 382, and 383		0**	0**	0**	0**
III. Additional Courses Approved by Adviser		0*	3*	0*	0*
Total		30	30	36	36

A¹—Thesis Program

B¹—Problem Program

C¹—36 Semester Hour Program

D¹—Internship Program

Other Certification Requirements

- a. Applicant must hold a permanent Professional Certificate.
- b. Applicant must complete 5 years of successful experience which shall include 3 years as a classroom teacher and 2 years as a general supervisor of instruction.
- c. Applicant must complete a Master's degree relevant to school instruction.
- *d. Education 331, C&G 373 and 6 semester hours of appropriate courses in teaching areas.
- *°e. Education 380, 381, 382, and 383 constitute the internship in supervision and are offered in cooperation with the county in which the applicant is employed.

Curriculum for Special Supervisors of Instruction

Degree: Master of Arts

I. <i>Required Courses</i>	Program	A ¹	B ¹	C ¹	D ¹
Ed. 211, 301		6	6	6	6
Ed. 331		3	3	3	*
Ed. 335 or 336		3	3	3	3
Ed. 339		3	3	3	3
Ed. 346		3	3	3	3
Ed. 348 or 349		3	3	3	*
Ed. 360		0	3	0	0
Ed. 361		6	0	0	0
C&G 303		3	0	3	*
II. <i>Internship</i>					
Ed. 380, 381, 382, and 383		**	**	**	8**
III. <i>Academic Courses Approved by Adviser</i>		0*	6*	12	12
Total		30	33	36	36

Other Certification Requirements

- a. Applicant must hold a permanent Professional Certificate endorsed for teaching each specialization or for each school area for which an endorsement is sought.
- b. Applicant must complete 3 years of successful classroom teaching and 2 years of successful supervisory service in the area for which an endorsement is sought.
- c. Applicant must complete a Master's degree relevant to the supervision of instruction.
- *d. Education 331, 348 or 349, C&G 303 and 12 semester hours of appropriate courses in the field of specialization.
- *°e. Education 380, 381, 382, and 383 constitute the Internship in supervision and are offered in cooperation with the county in which the applicant is employed.

A¹—Thesis Program
 B¹—Problem Program
 C¹—36 Semester Hour Program
 D¹—Internship Program

Curriculum for Secondary School Classroom Teachers†

Degree: Master of Arts

I. Graduate Courses in Education				12-18 Hr.
Required Courses				6 Hr.
	Program ¹	A	B	C
Ed. 336		3	3	3
Ed. 331 or C&G 373		3	3	3
Ed. 271		3	3	0
Ed. 301		3	3	0
Ed. 360		0	3	0
Ed. 361		6	0	0
Ed. 397		0	0	0
Total		18	15	6
II. Approved Electives				6 Hr. (Min.)
C&G 303, 305				
Ed. 221, 251, 259, 262, 270, 271, 274, 275, 284, 285, 301, 304, 305, 322, 331, 337, 338*, 339, 346, 348, 360, 361, 364, 367, 370, 371, 380*, 385, 395, 396, 397, 398.				
Rdng. 300, 301				
III. **Graduate Courses in one of the candidate's certified fields				12-18 Hr.
IV. ***Graduate Courses in another of the Candidate's teaching fields				6 Hr. (Min.)
Alternate Program for II, III, IV				
I. Graduate Courses in one of the candidate's certified teaching fields				18-24 Hr.
II. Free electives				0- 6 Hr.
Total for Master's Degree				30-36 Hr.

*May be taken as internship courses.

**Candidates with library science as a major teaching field must follow the curriculum for Teacher-Librarians.

***This provision does not apply to candidate pursuing Programs A or B.

Curriculum for Industrial Arts Teachers°

Degree: Master of Arts

I. Required Courses				Program ¹	A	B	C
Ed. 271					3	3	0
Ed. 301					3	3	3
Ed. 303					3	3	3
Ed. 310					3	3	3
Ed. 311					3	3	3
Ed. 360					0	3	0
Ed. 361					6	0	0
Ed. 365					3	3	3
Total					24	21	15

°Students wishing to pursue a program in home economics education must enroll in the Division of Family Resources.

¹A—Thesis required

B—Research problem required

C—36 semester hour program

†NOTE: In some programs listed on pp. 187-189 a combination of undergraduate courses and courses listed in graduate program is necessary to meet certification requirements.

II. <i>Approved Electives</i>	6	9	21
(Students electing Option C should maintain a close balance in total hours between professional and academic courses.)			
C&G 303, 305, 366			
Ed. 204 (IA), 221, 238 (IA), 240 (IA), 243 (IA), 244 (IA), 246 (IA), 248 (IA), 249 (IA), 251, 270, 271, 272, 275, 284, 285, 301, 319, 320, 321, 322, 324, 331, 336, 338, 339, 346, 348, 351, 353, 364, 370, 372, 385, 395, 396, 397, 398, 399.			
Total for Master's Degree	30	30	36

Curriculum for Elementary School Classroom Teachers*

Degree: Master of Arts

I. <i>Required Courses</i>	Program ¹	A	B	C	D
Ed. 271	3	3	3	3	3
Ed. 301	3	3	0	3	3
Ed. 306	3	3	3	0	0
Ed. 307	3	3	3	0	0
Ed. 308	3	3	3	3	3
Rdng. 300	3	3	3	3	3
Ed. 331	3	3	3	3	3
Ed. 335	3	3	3	0	0
Ed. 360	0	3	0	3	3
Ed. 361	6	0	0	0	0
Total	30	27	21	18	18
II. <i>Approved Electives</i>	0	3	15**	12	12
Astron. 216					
C&G 305, 330					
Ed. 202, 221, 223, 270, 274, 285, 301, 306, 307, 315, 316, 317, 335, 348, 370, 372, 380, 385					
Math. 270, 271					
Rdng. 282, 301, 304, 305					
Sp. Ed. 347, 368, 371, or academic courses approved by the adviser. (Academic deficiencies will have first consideration.)					
Total for Master's Degree	30	30	36	30	30

¹A—Thesis required

B—Research problem required

C—36 semester hour program for classroom teacher and Elementary Mathematics

D—Concentration in Elementary Mathematics

*See dagger NOTE on page 187.

**At least 9 hours of electives must be in courses not offered by Education or Clinical Studies.

Curriculum for Teacher-Librarians*

Degree: Master of Arts in Education

I. <i>Graduate Courses in Education</i>	12 Hr.
A. Required Courses in Education	6 Hr.
Ed. 301	
Ed. 360 (Library Science)	
B. Electives	6 Hr. (Min.)
C&G 303	
Ed. 221, 270, 271, 322, 331, 339, 385	

*See dagger NOTE on page 187.

II. *Graduate Courses in Library Science*
At least 6 hours must be in the 300 series.

12-18 Hr.

III. *Electives*

Total for Master's Degree

30 Hr.

Education

200. **Early Childhood Education.** SI. 3 hr. PR: CDFR 105, 106, Ed. 100, 105, 106, 141. An examination of the role that early childhood education plays in the development of the child. Attention is given to the scope, content, and nature of programs for young children as well as developing the knowledge, skills, and attitudes necessary for working in such programs. Students will be given opportunities to observe and participate in early childhood programs and to engage in research at this level.
201. **Early Childhood Education.** SII. 3 hr. PR: CDFR 105, 106, Ed. 100, 105, 106, 141, 200. Continuation of Ed. 200
204. **Advanced Woodworking, Construction, and Finishing (IA).** II, S. 3 hr. PR: Ed. 102 (IA), 103 (IA), or equiv. Selection of advanced projects, analysis of construction, planning, and finishing, application of machine tools.
216. **Sociology of Education.** I, II. 3 hr. An examination of education as a social institution; cultural and class influences on education; social roles and career patterns in the school system; the school and problems of the community.
221. **Audio-Visual Resources for Instruction.** I, II, S. 3 hr. PR: Ed. 105, 106. A survey is made of the many types of materials available for teaching. Multi-sensory techniques, sources of materials, and practical classroom utilization are considered. One hour laboratory period per week is arranged.
223. **Student Teaching Clinical Experience in Elementary, Secondary, and Mathematics Education.** I, II, S. 2-4 hr. PR: Consent. This is an advanced course in student teaching, stressing clinical procedures in classroom learning problems, industrial arts therapy, and other related areas.
238. **Design in Industrial Education (IA).** I, S. 3 hr. PR: Consent. Industrial education design; architectural drawing and model building. Emphasis on application of design components at the secondary school level.
- 240-250. These courses are designed to prepare versatile teachers of industrial arts and to meet State certification requirements. The abbreviated introduction to specific crafts through these courses is intended to provide broad rather than specialized experience and to prepare the teacher to teach the fundamentals of crafts rather than to attain vocational competence. Prospective teachers should elect, from these courses, those which will supplement their previous training in organizing and directing the industrial arts program.
240. **Art Metal and Jewelry (IA).** I, S. 3 hr. PR: Ed. 104 (IA) or equiv. Creative design and construction of art metal and jewelry involving the utilization of sheet, bar, and wire stock. Development of units suitable for the secondary school level is stressed.
242. **Upholstery and Finishing (IA).** I, S. 3 hr. PR: Ed. 102 (IA), 103 (IA) or equiv. and consent. Design and construction of upholstery units, reupholstery, finishing and refinishing. Construction of teaching units in these areas.
243. **Advanced Ceramics (IA).** II. 3 hr. PR: Ed. 121 (IA) or consent. Design in ceramics, construction of projects involving mold work, potter's wheel, and hand form methods. Experimentation with glazes including glaze composition. Development of suitable teaching aids involving ceramics.
244. **Advanced Industrial Arts Crafts (IA).** II, S. 3 hr. PR: Ed. 121 (IA). Experiments with crafts media in depth in the areas of plastics and leather. Development of suitable teaching units involving crafts materials.

246. **Advanced Industrial Arts Graphics (IA).** II, S. 3 hr. PR: Ed. 180 (IA) or equiv. Concentration in depth in one or more of the graphic arts media. Emphasis on offset methods of reproduction.
248. **Advanced Electricity (IA).** II, S. 2 hr. PR: Ed. 131 (IA) or equiv. A study of the technical phases of electricity with emphasis on planning shop courses, shop equipment and layout, and development in industrial aids.
249. **Sheet Metal Pattern Development (IA).** II, S. 3 hr. Layout problems involving parallel, radial, and triangulation methods. Construction of instructional units utilizing these principles.
251. **Production of Audio-Visual Materials.** I, II, S. 2 hr. PR: Ed. 221. Techniques of making audio-visual materials for use in teaching and school public relations programs are demonstrated. Individual projects of planning and producing materials are carried out by the student.
259. **The Music Education Program.** S. 3 hr. PR or parallel: Ed. 124 or consent. Organization and administration of the complete Music Education program for grades 1 through 12.
262. **Vocational Home Economics in Secondary Schools.** II. 3 hr. PR or parallel: Ed. 120, 124, 163; 25 hr. in Home Economics. Primarily for seniors and teachers of home economics.
270. **Special Problems and Workshops.** I, II, S. 2-4 hr. PR: 14 hr. in Education. To take care of credits for special workshops and short intensive unit courses on methods, supervision, and other special topics. Maximum of 8 semester hours may be applied toward the Master's degree, of which no more than 6 semester hours shall be in Extension.
271. **Educational Measurement.** I, II, S. 3 hr. PR: Consent. Background for educational measurement, the nature of evaluation, measuring and predicting pupil progress. Statistics includes measures of central tendency, percentiles, variability, and simple correlation. First course in statistics and research.
272. **Internship in Industrial Arts Therapy (IA).** I, II, S. 8 hr. Internship in a clinical setting providing individualized instruction in the teaching techniques of industrial arts and therapeutic practices in rehabilitation of the handicapped.
274. **Workshop: Economic Education.** S. 3 hr. A workshop for principals, teachers, and supervisors with emphasis on the economic structure of our society and methods of integrating economics into the school program. Sponsored jointly by the College of Human Resources and Education and the College of Commerce.
275. **Curriculum Principles and Patterns in General Education.** II. 2 hr. PR: 6 hour undergraduate education and senior rank. Major emphasis on principles, philosophy, and concepts of general education in secondary schools; means and ends in general education: core, subject matter, integrated studies, broad fields, activity.
276. **Teaching Young and Adult Farmer Classes.** I, S. 2 hr. PR: Ed. 100, 105, 106. Participation in conducting young and adult farmer classes and school-community food preservation centers; organization, course of study, and methods of teaching and supervision, and young farmers' association.
277. **Organizing and Directing Supervised Farming Programs.** II, S. 2 hr. PR: Ed. 160 or consent. Planning programs of supervised farming, supervising and evaluating such programs for all-day students, young farmers, and adult farmers.
285. **The Junior High School.** I, II. 2 hr. PR: Ed. 100, 105, 106, and consent. Development, philosophy, program, and practices of the junior high school.
301. **Introduction to Education Research.** I, II, S. 3 hr. PR: Ed. 271 or 211. Required of all candidates for the administrative, supervisory, Options A and B

for the Master's degree and several other programs. Methods, techniques, statistical measures, interpretations, and reporting of research.

303. **History of Industrial Education.** I, S. 3 hr. Survey of development of industrial education in Europe and America to 1917. Research on modern development since 1917 including contributions of contemporary leaders.
306. **Social Studies in the Elementary School.** I, II, S. 3 hr. PR: 20 hr. of undergraduate credit in elementary education, or consent. Comprehensive consideration of objectives, content, methods, including unit procedures; materials including objects, models, exhibits, and museum items as well as textbooks, collateral reading, maps, and graphs; and means of evaluating social growth and development.
307. **Science in the Elementary School.** I, S. 3 hr. PR: 20 hr. of undergraduate credit in elementary education, or consent. An analysis of methods, curriculum patterns, and trends in elementary school science. Attention is given to the understanding and development of scientific attitudes appropriate at the elementary school level.
308. **Mathematics in the Elementary School.** II, S. 3 hr. PR: 20 hr. of undergraduate credit in elementary education or consent. Materials and methods of instruction for modern mathematics programs.
310. **School Shop Planning.** I, S. 3 hr. Selection, purchases, arrangement, installation and use of equipment for all instructional levels and types of school laboratories. Construction of 3-D scale models of typical industrial education laboratory facilities.
311. **School Shop Safety Programs.** II, S. 3 hr. Consideration of factors involved in school shop accidents; safety measures appropriate to schools and industry; theory of tort liability involving industrial education teachers.
315. **Current Practices in Elementary Education.** I, II, S. 2 hr. PR: Consent. Critical analysis of modern techniques and practices in the elementary school.
316. **Corrective Techniques in Mathematics Education.** I, S. 3 hr. PR: Ed. 308. Materials and methods used in diagnosis and remediation of learning difficulties in mathematics.
317. **Survey of Major Issues in Mathematics Education.** II, S. 3 hr. PR: Ed. 308. Individual and group research on selected topics in mathematics education.
318. **Planning Programs and Courses for Vocational Agriculture Departments.** I, S. 2 hr. PR: Ed. 124. Gathering data, studying the farming problems of all-day students, young farmers, and adult farmers, and planning the total program for the department.
319. **Special Problems in Teaching General Shop.** S. 3 hr. PR: Ed. 107 (IA) or equiv. Problems peculiar to teaching industrial arts in the general shop.
- 320, 321. **Special Topics in Industrial Arts.** I, II, S. 2-3 hr. each. PR: Consent. For graduate students in industrial arts. Special projects of improvement in phases needing special attention.
322. **Organizing Audio-Visual Programs.** II, S. 2 hr. PR: Ed. 221. Audio-visual techniques with emphasis on selection and utilization of materials, audio-visual centers, inservice programs, budgetary planning, and curricular implementation.
325. **Practice in Administration in Elementary Schools.** I, II. 2 hr. PR: Consent. Practice in leadership pertaining to elementary school organization and administration according to the needs of the school and/or school system.
326. **Practice in Elementary-School Supervision.** I, II, S. 2 hr. PR: 6 graduate hours of elementary education, or consent. Observing and practicing major activities of the supervisor in work with pupils and teachers. To be taken late in student's candidacy.

327. *Demonstration and Practice in the Supervision of Secondary-School Instruction.* I, II, S. 3 hr. PR: Consent. Observation and practice of approved methods and techniques in classroom supervision of instruction. To be taken late in student's candidacy.
328. *Practice Administration in the Secondary School.* I, II, S. 2 hr. PR: Consent. Internship study of school organization and administration.
331. *Philosophy of Education.* I, II, S. 3 hr. A study of educational aims, values, and criteria of education in a democracy. Stresses different systems of educational philosophies, the nature of thinking applied to methods, and subject matter.
335. *The Elementary-School Curriculum.* I, S. 3 hr. PR: 20 hr. of undergraduate credit in elementary education, or consent. An analysis of curriculum designs in elementary education with emphasis on methods and techniques of development.
336. *The Secondary-School Curriculum.* I, II, S. 3 hr. PR: High-school teaching experience, or consent. Emphasizes socio-economic and cultural influences on the curriculum; principles of curriculum development; curriculum building in the various teaching fields; techniques of experimentation and evaluation; and practice in curriculum building with special emphasis on unit construction.
337. *Problems in Elementary and Secondary-School Curriculum.* I, II. 2 hr. PR: 8 hr. graduate education, including Ed. 336. Critical study of selected problems in curriculum with special emphasis on research.
338. *Problems in the Secondary School.* I, II. 2 hr. PR: Consent. Culminating internship course for principals. Required research project designed to improve instruction and/or administration of the school.
339. *Public School Organization and Administration.* I, S. 3 hr. PR: 20 hr. of education courses. Provides basic concepts through which administrators, supervisors, and teachers gain understanding of basic problems related to the operation of schools and school systems.
340. *Public-School Finance.* II, S. 3 hr. PR or Conc.: Ed. 339 and consent. Sources of school support; taxation; efficient management of school money, improved budget practices and adequate apportionment plans. To be taken late in student's candidacy.
341. *School Buildings and Equipment.* I, S. 2 hr. PR or Conc.: Ed. 339 and consent. Philosophy, planning, and management of the school plant as an appropriate educational environment.
342. *Public Education and the Law.* I, S. 3 hr. Legal permissives and limitations involved in setting policy for, organization of, and administration of public schools.
343. *School Surveys.* I, II, S. 2 hr. PR or conc.: Ed. 339 and consent. Development of the educational survey as an instrument for improving educational procedures.
344. *Staff-Personnel Administration.* S. 2 hr. PR or conc.: Ed. 339, consent. Selection, induction, direction, evaluation, improvement, and promotion of members of the administrative, supervisory, instructional, research, clerical, and maintenance staffs.
345. *Seminar in Educational Leadership.* I, II, S. 2-8 hr. PR: Consent. An integrated study of the problems of school leaders in the areas of administration, supervision, and instruction.
346. *Principles of Supervision.* I, II, S. 3 hr. PR: Consent. Basic, general principles of elementary-school, junior high-school, and senior high-school supervision.
349. *Human Development and Behavior.* I, II, S. 3 hr. A study of the interrelationship of physical and environmental factors as these affect behavior of children and youth.

349. **Psychological Foundations of Learning.** I, II, S. 3 hr. A study of the psychological and philosophical foundations of major learning theories.
350. **Inter-Disciplinary Seminar for School Administrators.** I, II, 6 hr. PR: Consent. A study of the academic disciplines pertinent to school administration.
351. **Communications and New Educational Media.** I, S. 3 hr. The psychological implications of communications media in learning and teaching. Attention to educational television, programmed instruction, cross-media, techniques, and experimental and developmental programs.
353. **The Secondary-School Principal.** S. 3 hr. PR: Ed. 339 and high-school teaching experience, or consent. Open only to graduate students in Education, late in candidacy. A study of the function of administration in the modern secondary school, emphasizing the role of the principal in the improvement of instruction, the development of curriculum, and the organization of personnel services.
356. **Elementary-School Principal.** S. 3 hr. PR: 6 graduate hours of elementary education, or consent. A study of the function of administration in the modern elementary school, emphasizing the role of the principal in the improvement of instruction, the development of curriculum, and the organization of personnel services.
360. **Problem in Education.** I, II, S. 3 hr. Research for Master's degree in Education, option B.
361. **Thesis in Education.** I, II, S. 6 hr. Research for Master's degree in Education, option A.
362. **Project in Education.** I, II, S. 3-6 hr. Research for the program leading to the Certificate of Advanced Study in Education.
364. **Advanced Methods in Teaching Industrial Education.** II, S. 3 hr. PR: Ed. 194 or consent. Trends in Industrial Education reflecting modern teaching methods; classroom representation of industrial methods; effective use of the newer instructional media.
365. **Curriculum Construction in Industrial Arts.** S. 3 hr. PR: Consent. Techniques used in building curriculum designs in industrial arts.
367. **Social Studies in Secondary Schools.** I, S. 3 hr. PR: Consent. Nature and function of social studies in the secondary school; utilization of community, state, national, and world resources in teaching; selection of content for teaching purposes; curriculum construction with emphasis on resource and teaching units.
370. **Principles of Instruction.** I, II, S. 3 hr. PR: Consent. Emphasizes the basic principles of teaching-learning process implied in major learning theories; study of factors in learning such as problem solving, competencies needed by teacher; improving techniques common to traditional and modern methods of instruction.
372. **Statistical Analysis in Education.** I, II, S. 3 hr. PR: Ed. 271 or consent. Review measures of central tendency, percentiles, and correlation. Emphasis placed on correlation, regression, testing hypothesis, non-parametric tests, and other measures in analysis and inference.
- 380, 381, 382, 383. **Practice in Supervision.** I, II, 2 hr. ea. PR: Assignment to actual full-time work in supervision in a school system, previous certification, and consent. Each course a continuation of the preceding. To complete the entire 8 hours, not less than two full years of field experience will be accepted.
385. **Historical and Sociological Foundations of American Education.** I, II, S. 3 hr. A study of the development of American education. Emphasis placed upon movements and leaders.
- 395, 396, 398. **Practicum.** I, II, S. 2-4 hr. per sem. or term—aggregating not more than 12 hr. PR: 8 graduate hr. in Education. Enrollment with permission of

adviser or instructor in consultation. Special individual and group projects. To provide appropriate residence credits for special workshops, prolonged systematic conferences on problems and projects in Education. Credits in these projects cannot be substituted for required courses.

397. **Dissertation Research.** I, II, S. 1-15 hr. Research for the Doctor of Education degree.
399. **Seminar in Educational Research.** II. 2 hr. PR: Ed. 301 and consent. Application of research methods and techniques to problems in modern education; analysis and implications of results.

Health Education

201. **Advanced School Health.** I, S. 3 hr. PR: Health Educ. 101, 20 hr. of Education, graduate standing and consent. An analysis of problems in school health services, healthful school living, the nature of health education, and the scope of health instruction which confronts teachers and administrators.
205. **Philosophy of Health Education.** I, S. 3 hr. PR: Health Educ. 101, or 102, graduate standing and consent. Analysis of the scientific bases, purposes, procedures, and content, with implications for school and public health education programs.
301. **Community Health.** II, S. 3 hr. PR: Health Educ. 205, or equiv. Health problems requiring community action, basic public health activities, community organization for health protection, voluntary health agencies, school health programs and the role of state and federal agencies in the community health program.
376. **Evaluation of Health Information.** I, S. 3 hr. PR: Health Educ. 201, or 20 hr. of Education and consent. Study of published material to determine basic scientific accuracy and value.
394. **Seminar in Health Education.** I, II, S. 4 hr. PR: Health Educ. 205. An overview and critical analysis of the literature and research in health education.
397. **Individual Research Problems in Health Education.** I, II, S. 1-15 hr. PR: Minimum of 6 sem. hr. in Health Educ., including Health Educ. 205, and Educ. 301. Opportunity for independent study and investigation of pertinent problems. For advanced students with practical experience.
398. **Practicum in Health Education.** I, II, S. 4 hr. PR: Health Educ. 394. Program planning, curriculum development and job functions in health education.

MEDICAL TECHNOLOGY

A master of science degree is offered by the Division of Medical Technology of the School of Medicine with the cooperation of the Division of Education, College of Human Resources and Education. Individuals entering this program should be mature, experienced medical technologists who desire to strengthen their skills in teaching, administration, and supervision, and to broaden their knowledge in the specialties of medical technology. The program is designed to permit as much freedom in the choice of course work as possible and to provide an opportunity for recognition and development of the student's abilities.

The admission procedure is the same as for other programs in the Graduate School. Applicants must have a bachelor's degree from an accredited institution. The desired area of concentration in medical technology is considered in the evaluation of the undergraduate record. Applicants are selected for admission on the basis of scholastic standing, recommendations, and interest in the field of health and medical technology education. The number of applicants accepted is limited by the available facilities.

The course of study is tailored to the needs of the student. It is expected that students who enter the program have a goal in mind and a special field of interest in medical technology. A minimum of 36 semester hours of credit, including a research problem or thesis, is required. These credits are distributed among courses in: (1) an area of concentration in medical technology selected by the student, (2) research and statistics, and (3) health education.

The student has ample opportunity to satisfy individual goals through elective courses and research. Elective courses are not specified and will vary from student to student.

The program can be divided into three areas, as follows:

Area of Concentration: Graduate courses in hematology, microbiology, chemistry, cytology, and histopathology are available. Special work in the clinical phases of medical technology is obtained through registration in Med. Tech. 397 (1-15 hr.). This course gives the student an opportunity to work in special areas such as administration, education, hematology, blood banking, clinical chemistry, and microbiology under the guidance of a member of the graduate faculty.

Required Courses in Research and Statistics:

Educ. 271. **Educational Measurement. I, II, S. 3 hr. PR:** Consent. Background for educational measurement, the nature of evaluation, measuring and predicting pupil progress. Statistics includes measures of central tendency, percentiles, variability, and simple correlation. First course in statistics and research.

Educ. 301. **Introduction to Educational Research. I, II, S. 3 hr. PR:** Ed. 271 or 372. Required of all candidates for the administrative, supervisory, Options A and B for the Master's degree and several other programs. Methods, techniques, statistical measures, interpretations, and reporting of research.

Med. Tech. 397. **Individual Research Problems (1-15 hr.).** Opportunity for independent study and investigation of pertinent problems in medical technology. A problem from the field of medical technology is selected. The problem may be from one of the specialties of medical technology such as microbiology, histopathology, chemistry, blood banking, hematology, or it may be a study in medical technology education and/or administration. An outline of the problem must be submitted (3 copies) for approval before the work on the problem is begun. This outline can be a part of the course work of Education 301. The adviser for the problem must be a member of the graduate faculty, and the problem must be approved by the coordinator of the program. The problem is to be reported in a paper following accepted thesis style.

In order that the graduate student will be aware of other fields in the health sciences the following 3-hr. courses are required:

Health Ed. 201—Advanced School Health

Health Ed. 205—Philosophy of Health Education

Health Ed. 301—Community Health

Safety Ed. 283—Safety Education

Health Ed. 376—Evaluation of Health Information

Requirements for Degree

All requirements for the degree of master of science, as outlined in Part II of this bulletin, must be met. These requirements can be fulfilled in three semesters by full-time students. If necessary, additional time may be permitted.

Degree candidates must have a 3.0 grade-point average for graduation and must successfully pass comprehensive examinations.

Examinations include:

A. A preliminary comprehensive examination in Health Education after completion of twelve semester hours of work in residence. (It is the student's responsibility to make arrangements for this examination.)

B. A written final comprehensive examination given one month prior to the granting of the degree. This examination covers the field of:

1. Medical technology with emphasis on the area of concentration.
2. Research and statistics.
3. Health Education.

C. An oral final comprehensive examination on the student's problem given after the problem is completed.

DIVISION OF FAMILY RESOURCES

The Division of Family Resources offers work leading to the degree of Master of Science.

All candidates for the graduate degree must conform to the general regulations of the Graduate School and the rules of the Division of Family Resources.

After applying to the Graduate School, applications will be reviewed by the Graduate Admissions Committee of the Division. At that time, an applicant will be notified by the Chairman of the Graduate Admissions Committee of the Division that he is accepted conditionally, or not accepted for graduate study in the Division. A student must maintain a 3.0 grade-point average in course work taken within the Division in order to be awarded the master's degree from the Division of Family Resources. Additional detailed information may be obtained by writing the Director of the Division.

The graduate program of the Division is designed to offer qualified students opportunity to work in a variety of different specializations as well as the opportunity to take graduate level course work in supporting disciplines.

The specializations generally will coincide with the subject matter areas offered in the Division. However, the specific course work requirements for the degree of Master of Science will in all cases rest with the graduate guidance committee of the student, and be approved by the Director of the Division.

To enter the graduate program of the Division, an applicant must have a bachelor's degree from an accredited institution and sufficient background in the area of specialization to qualify for admission to graduate courses in that area.

As of January 1, 1967, *no* student will receive graduate credit for course work taken prior to or concurrent with the semester in which his graduate application is received by the Division. In very exceptional cases, and not to include any circumstances surrounding lateness of application, course work taken prior to application to the Graduate School may be approved with the written consent of the entire graduate guidance committee of the student. Attached to such an application for approval of prior course work will be a statement by the student explaining the circumstances of the situation. Such application will be submitted first to the Chairman of the Graduate Admissions Committee of the Division for approval before being sent for approval to the student's guidance committee.

A student will select either (A) the thesis or (B) the course work program:

(A). The student pursuing the thesis program will take a minimum of 30 semester hours of course work, including 6 semester hours of credit for the thesis. Before the student in the thesis program has enrolled in more than 15 hours of course work, his graduate guidance committee will approve in writing his total graduate program. The graduate guidance committee of each student will be considered by the student and the major professor in selecting a thesis topic and in completing the thesis requirement. The approval of the thesis following an oral examination by the graduate guidance committee of the student will be required before the degree is granted. The graduate guidance committee of each student shall consist of at least three members of the Graduate Faculty of the University, at least two of whom must be members of the Graduate Faculty of the Division of Family Resources.

(B). The student completing the course work option will take a minimum of 36 semester hours of credit, approved by his graduate guidance committee, and, near the end of his graduate study, be required to take a written comprehensive examination. This examination shall be prepared, evaluated and approved by at least three members of the Graduate Faculty of the University before the degree is granted.

Approval in writing must be secured in advance from the student's graduate guidance committee to elect graduate course offered at other institutions or by University Extension.

Home Economics Education

- 211. **Evaluation in Home Economics. I.** 3 hr. PR: 30 hr. of Home Economics, 7 hr. of Education or consent. Experience in devising, selecting, and using a variety of techniques for evaluating progress toward cognitive, affective, and psychomotor objectives in home economics. Offered alternate odd years.
- 212. **Adult Education in Home Economics. I.** 3 hr. PR: 30 hr. of Home Economics and 7 hr. of Education or consent. A study of adult education as that part of the local home economics program which contributes to meeting needs of people for continuing education throughout the various life stages. Attention given to organization of classes and to selection of content, methods, and materials. Offered alternate even years.
- 311. **Home Economics Curriculum. II.** 3 hr. PR: Experience in teaching home economics or consent. Theory and research in curriculum applied to home economics. Emphasis on change within existing programs and development of new programs. Offered alternate even years.
- 312. **Supervision in Home Economics.** 3 hr. PR: Teaching experience and consent. Designed for home economics teachers preparing to serve as supervising teachers in off-campus training centers. Function of supervision and organization of supervised teaching program. Techniques for helping students in training for teaching home economics.

Housing and Design

- 233. **Interior Design II. II.** 3 hr. PR: HD 33, 133 or consent. Technical and design information necessary to comprehend and function within the contemporary home furnishings market.

Child Development; Family Relations

- 241. **Cognitive Development of the Child. I.** 3 hr. PR: CDFR 141 and 142 or consent. A normative survey of logical thought development from infancy to adolescence. Emphasis is directed toward the growth of spatio-temporal, quantity-numerical, spatial-geometric, and infralogical concepts and their relationship to basic sensory-perceptual functioning during the 2-year to 12-year-old interval.
- 242. **Socio-Emotional Development of the Child. II.** 3 hr. A study and examination of contemporary theory and research into various facets of the socialization process and the development of attitudes in the child.
- 244. **Family and Individual in the Community. I.** 3 hr. PR: One course in the family, or sociology, or consent. Social psychological analysis of the individual in the family and in other social systems. Involves the study of role relationships, community processes and attitudes and values as they affect the behavior of the individual.
- 245. **Family Development. I, II.** 3 hr. PR: CDFR 144 or consent. A course designed to increase knowledge and understanding of comparative family patterns through the use of cross-cultural and historical materials. Intensive study of

family development in contemporary United States with special attention to social class differences and the use of the life cycle and developmental task concepts as analytic tools.

- 247. **Comparative Study of the Family.** II. 3 hr. PR: CDFR 144 or consent. The comparative method as a framework for family analysis. The family as both an independent and dependent variable in social change in relation to other social systems. Modal and unique patterns of structure and functioning. Alternative methods for achieving similar cultural objectives. Converging patterns in the contemporary world setting.
- 248. **Theories of Child Development.** II. 3 hr. PR: CDFR 141, 142 or consent. An examination of the major theoretical conceptions of child development. The work of Werner, Piaget, Lewin, Freud, and the American learning theorists will be covered.

Foods; Institution Administration

- 255. **Experimental Foods.** II. 3 hr. PR: FIA 55, Chem. 131, or consent. (1 hr. lec., two 2-hr. labs.) The study and experimentation with factors involved in food processing under various conditions. Offered alternate odd years.
- 258. **Laboratory Practice in Institution Management.** I, II. 3 hr. PR: FIA 158 and consent. Experience under supervision in planning, preparing and serving food in an institution. Selection of place and type of experience to be determined by needs of students.

Home Management; Family Economics

- 261. **Consumer Economics.** II. 3 hr. PR: Econ. 51, HMFE 161, or consent. Course designed to help students understand the role of consumer in our economy. Involves the study of research methods and techniques being used to identify, understand, and solve consumer problems.

Nutrition

- 271. **Human Nutrition.** I. 3 hr. PR: NTR 71, biochemistry, physiology. The role of food nutrients in the physiological and biochemical processes of the body; nutritional needs of healthy individuals under ordinary conditions and in periods of physiologic stress. Offered alternate even years.
- 273. **Family and Community Nutrition.** II. 3 hr. PR: Consent. Special emphasis is given to nutritional status of the individual and family in the community. Students study nutritional problems and work toward their solutions through fieldwork.
- 274. **Diet Therapy.** II. 3 hr. PR: NTR 274, Zool. 271. Adaptations of normal diet for diseases whose prevention or treatment is largely influenced by diet. Offered in alternate odd years.

Family Resources—Seminars

- 281. **Seminar in Home Economics Education.** I, II, S. 1-4 hr.; max., 9 hr. PR: Senior standing and consent. A review and discussion of home economics education at secondary, college, and adult levels. Emphasis on current research and trends in selected areas. Offered alternate odd years.
- 282. **Seminar in Clothing or Textiles.** I, II, S. 1-4 hr. per sem.; max., 9 hr. Critical examination of significant contemporary issues in the area of clothing or textiles.
- 283. **Seminar in Housing or Design.** I, II, S. 1-4 hr. per sem.; max., 9 hr. Critical examination of significant contemporary issues in the area of housing or design.

284. **Seminar in Child Development.** I, II, S. 1-4 hr. per sem.; max. 9 hr. Critical examination of significant contemporary issues in the area of child development.
285. **Seminar in Foods and or Institution Administration.** I, II, S. 1-4 hr. per sem.; max. 9 hr. Critical examination of significant contemporary issues in the area of foods and/or institution administration.
286. **Seminar in Home Management or Family Economics.** I, II, S. 1-4 hr. per sem.; max., 9 hr. Critical examination of significant contemporary issues in the area of home management or family economics.
287. **Seminar in Nutrition.** I, II, S. 1-4 hr. per sem.; max., 9 hr. Critical examination of significant contemporary issues in the area of nutrition.
384. **Seminar in Family Relations.** I, II, S. 1-4 hr. per sem.; max., 9 hr. An examination of research procedures used in the study of family relationships and a critical examination of current research in this area.
387. **Graduate Seminar in Nutrition.** I, II, S. 1-4 hr. per sem.; max., 9 hr. Review and discussion of recent progress in foods and/or nutrition research.

Family Resources—Research

390. **Research Methods in Family Resources.** I, II, S. 3 hr. PR: Introductory statistics or consent. A review of research methodology, experimental design, and statistical analysis as relevant to problems in home economics, child development, and family relations. Required for all master's thesis candidates in the Division of Family Resources.
391. **Assigned Topics.** I, II, S. 1-6 hr. per sem.; max. 9 hr.
397. **Research.** I, II, S. 1-15 hr. Research for the degree of Master of Science in Family Resources.

DIVISION OF SOCIAL WORK

The graduate program in social work education leads to the degree of Master of Social Work, accredited by the Council on Social Work Education. It spans two academic years and one summer session.

In social work, social science knowledge is utilized to understand the behavior of individuals, groups, and communities. This knowledge is employed by the social worker to develop a system of practice that will enable people and their institutions to achieve desirable social functioning.

Learning occurs in the classroom and through direct experience in working with people to alleviate personal problems and to improve adverse conditions in communities. The student spends two full semesters in social work settings which have been carefully selected to provide learning experiences.

The Appalachian region, of which West Virginia is a part, offers unique opportunities to study and work with a changing social environment. Parts of the territory are redeveloping from worked-out farms and mines to new industrial areas, bringing about out-migration and in-migration of population with problems of personal adjustment and the re-establishment of social organizations. This natural laboratory of human experience is utilized during the semesters on campus and those in field instruction in agencies and programs in or near the State of West Virginia.

CURRICULUM

The five major instructional components are human behavior and the social environment, practice, social welfare policy and services, field instruction, and research.

The social worker is concerned with human behavior as it is manifested in the individual, in groups, and in communities. In order to understand these kinds of social phenomena, concepts from anthropology, sociology, psychology and psychiatry have been selected for study. They are applied to an interpretation of conformity and deviance, including behavior, such as over-compliance, neuroses, delinquency, mental illness, anomie, and alienation. Behavior is interpreted as the product of interaction between the individual and the social organizations and cultural norms to which he is exposed. Those concepts are selected from the social sciences which enhance this interpretation.

The Division of Social Work offers a program which emphasizes a unitary approach to social work practice. The student is helped to become a "specialized generalist" capable of understanding and actively engaging in a wide array of professional behaviors relevant to the range of social work responsibilities.

Throughout his first year in graduate studies, the student is taught an integrated approach to social work practice, providing him with the foundation principles, techniques, and values to practice social work with social systems of various sizes—from individuals to communities—as particular tasks require.

In his second year the student has an opportunity to develop specialized expertise to complement his generalist capacities by electing a concentration in either social work practice affecting individuals, families, and groups, or social work practice affecting organizations, institutions, and communities.

Emphasis throughout the social welfare policy and services courses is placed upon values, conflict of interest, professionalism, methodology, history, ideology, economics, and socio-legal-political change as they relate to policy formation, and the tasks, resources and roles of the social work professional. The courses deal with an analysis of the creation, institutionalization and planning of social welfare policy and service in a democracy. Extensive consideration is given to selected social problems, such as poverty, health, family planning, crime, housing, urban decay, the redistribution of political and economic power, the socio-economic problems of Appalachia, and planning the future, as they affect and are affected by policy formulation.

The objective of the research sequence is to prepare the graduate social work student as a consumer of research information having a bearing on solving problems the social worker confronts. Also, the student is prepared to participate in research as an investigator familiar with some of the technical and practical aspects of research design and activity. The student is also prepared to identify research problems and formulate research questions in social work.

Field instruction is an integral part of the graduate social work program. It is the component through which the student is enabled to incorporate into his professional behavior the content learned in all areas of the curriculum.

In both the first and second year, students are assigned to field instruction placements for a period of one semester. These field teaching and learning experiences are provided by field instructors who may be employed by the Division of Social Work or who may be members of an agency staff. All field instructors work closely with faculty consultants in providing an opportunity for practice and learning in accordance with the Division's educational goals and objectives.

The learning experiences provided are designed to assist the student in acquiring an integrated practice and in developing the discipline and self-awareness essential to the professional social worker.

Primary consideration in making field instruction assignments is in the selection of field settings and placements which can fulfill the educational goals and objectives of the Division and which can meet the particular educational needs of the student. In the selection of assignments, consideration is given to the student's area of interest, family situation, and stipend requirement.

Field Instruction Agencies—1968-1969 Academic Year

<i>Agency</i>	<i>Field Instructor</i>
Appalachian Center The University Extension Services (Marion County) West Virginia	David Williams Assistant Professor
Centerville Clinic Centerville, Pa.	Walter Golembiewski Field Instructor
Child Welfare Services of Fayette County Uniontown, Pa.	James Reed Field Instructor
Child Welfare Services of Washington County Washington, Pa.	Louise Abel Field Instructor
Children and Family Service Wheeling, W. Va.	Palmer Ulman Field Instructor
Children's Home Society of West Virginia Charleston, W. Va.	Dorothy Halstead Field Instructor
Family Counseling—Travelers Aid of the Kanawha Valley Charleston, W. Va.	Virginia B. Myers Instructor
Family Service Association of Morgantown, W. Va.	Helen S. Ellison Assistant Professor
Information and Volunteer Services of Allegheny County Pittsburgh, Pa.	Aaron Sacks Catherine Hamilton Field Instructors
Robert F. Kennedy Youth Center Morgantown, W. Va.	C. Courtney Elliott Assistant Professor
Mountain Mental Health Services Prestonsburg, Ky.	Richard Stai Field Instructor
The Shack Neighborhood House Pursglove, W. Va.	David Williams Assistant Professor
Valley Counseling Center Morgantown, W. Va.	O. B. Fawley Field Instructor
Veterans Administration Hospital Chillicothe, O.	Arlen D. Miller Nicholas J. Kempf Field Instructors
Veterans Administration Hospital Huntington, W. Va.	Robert Ewing Field Instructor
Veterans Administration Hospital Leech Farms Pittsburgh, Pa.	Alma Burgess Field Instructor
Washington County Board of Public Assistance Washington, Pa.	Helen Farrar Field Instructor
West Virginia University Medical Center Department of Psychiatry Morgantown, W. Va.	John Isaacson Assistant Professor

Weston State Hospital
Weston, W. Va.
Youth Development Center
Loysville, Pa.

James Chapman
Field Instructor
Joseph Anderson
Field Instructor

Kanawha Valley Graduate Center

Students may earn credit toward their Master's degree in Charleston, West Virginia, at the Kanawha Valley Graduate Center. A part-time program will be offered beginning the fall semester, 1969, and the full-time program with the fall semester, 1970.

For details, write to the Director of Branch Programs, Division of Social Work, West Virginia University, Morgantown, West Virginia 26506.

ADMISSIONS

Students are admitted for graduate study in the Division of Social Work who meet all of the following requirements:

1. Graduation with a bachelor's degree from any accredited college or university.
2. Although no specific grade-point average above the Graduate School minimum is required, it is expected that the quality of undergraduate record and/or Graduate Record Examination score will be strong enough to assure the candidate's ability to do creditable work at the graduate level.
3. Evidence of a capacity to successfully practice social work such as commitment to human service, concern about and ability to work effectively with people.

Admission with Advanced Standing

Students may be admitted to the second-year program after the satisfactory completion of one year of comparable social work education, if they meet the general requirements for admission to the graduate program.

Part-Time Program

Applicants may elect to extend their graduate program up to a maximum of four years by specifically requesting part-time status in their application for admission. To be accepted the student must meet the usual University and Division entry requirements, have a definite objective of completing the Master's program within a four-year period, and present an acceptable study plan for completing requirements developed with the assistance of a faculty adviser. Part-time credit programs are offered in both Morgantown and Charleston.

Date for Application and Enrollment; Application Material and Information

Applicants are urged to complete their applications before March 1 in order to guarantee consideration for admission and financial aids. Full-time students are admitted in the fall of each academic year only.

For further information and application materials, write to the Director of Admissions, Division of Social Work, College of Human Resources and Education, West Virginia University, Morgantown, West Virginia 26506.

Requirements for the Degree of Master of Social Work

The degree of Master of Social Work is conferred by the University upon those students who satisfactorily complete the requirements as established by the Graduate School. These requirements are:

1. Completion of graduate courses approved by the Division of Social Work totaling not fewer than 61 semester hours.
2. Satisfactory completion of all components of the graduate program.
3. A cumulative average of 2.7 overall for the total graduate program.

Required Graduate Social Work Program, 1969-1971

First Year, 1969-70

<i>Fall Semester</i>	<i>Credit</i>
SW 301—Introduction to Social Work Practice	5
SW 321—Human Behavior and the Social Environment I	4
SW 331—Social Welfare Policy and Services I	3
SW 397—Research (Principles and Theory)	3
	<hr/> 15
<i>Spring Semester</i>	
SW 381—Field Instruction	5-14

Second Year, 1970-71

<i>Summer Session</i>	
SW 302—Practice Affecting Individuals, Families, & Small Groups	2
SW 311—Practice Affecting Organizations, Institutions, & Communities	2
SW 322—Human Behavior and the Social Environment II	2
SW 332—Social Welfare Policy and Services II	2
SW 397—Research (Methods and Design)	3
	<hr/> 11

<i>Fall Semester</i>	
SW 382—Advanced Field Instruction	5-14

<i>Spring Semester</i>	
SW 303—Advanced Practice Affecting Individuals, Families, and Small Groups	3
or	
SW 312—Advanced Practice Affecting Organizations, Institutions, and Communities	3
SW 323—Human Behavior and the Social Environment III	2
SW 333—Social Welfare Policy and Services III	2
SW 341—Social Work Management	3
SW 388—Seminar (or elective)	3
SW 397—Research (Project or advanced course)	2
	<hr/> 15

Social Work Courses of Instruction

General Prerequisites. A concentration of courses in the social sciences is highly desirable for entrance into social work education because this knowledge is reviewed and applied to the practice of social work. Students lacking this background are expected to compensate for it by independent study.

With the exceptions of Social Work 212, 213, and 215, enrollment in graduate social work courses is limited to students admitted to the graduate program, except with special permission of the instructor. Two-hundred level courses are open to advanced undergraduate and graduate students in other programs. They do not provide credit toward the M.S.W.

212. **Introduction to Social Welfare.** 3 hr. A general introduction to social welfare in the United States: history, philosophy, programs, and problems. Social welfare as a social institution is examined. The emphasis is on what the citizen needs to know about welfare problems and solutions.
213. **The Field of Social Work.** 3 hr. PR: S.W. 212. A critical analysis of theory and practice in major areas of welfare, including public assistance, the care of dependent children, mental health, and service for the aged.
215. **The Profession of Social Work.** 3 hr. PR: S.W. 212. Social work as a professional service; its place in society; its purpose, underlying values, knowledge, and methods.
301. **Introduction to Social Work Practice.** 5 hr. Introduction to basic concepts, principles, values and skills intrinsic to all social work practice with an emphasis on the range of social tasks and the nature and purposes of social work intervention.
302. **Practice Affecting Individuals, Families, and Small Groups.** 2 hr. Social Work Practice "A". This course builds on S.W. 301 by elaborating and differentiating specific processes which have the primary goal of aiding in restoring, maintaining, or enhancing the social functioning of individuals, families, and small groups through various social systems.
303. **Advanced Practice Affecting Individuals, Families, and Small Groups.** 3 hr. A seminar in advanced practice to enhance expertise in that area of practice begun in S.W. 302. This course will integrate field experience as well as content of S.W. 311.
311. **Practice Affecting Organizations, Institutions, and Communities.** 2 hr. Social Work Practice "B". This course builds on Course 301 by elaborating and differentiating specific strategies and tactics in social work practice with the primary goal of effecting social change in organizations, institutions, and communities through the various social systems.
312. **Advanced Practice Affecting Organizations, Institutions, and Communities.** 3 hr. A seminar in advanced practice drawing on courses S.W. 301 and S.W. 311 and field experiences to enhance expertise in a concentration in social work with the primary goal of effecting change in organizations, institutions, and communities through the various social systems.
321. **Human Behavior and the Social Environment I.** 4 hr. Human behavior is interpreted as the product of interaction between the individual and the social organizations and cultural norms to which he is exposed. The effects upon the individual and his family of deprivation caused by poverty and social exclusion are studied. Selected theories of personality are related to the types of behavior that develop under different environmental conditions. The mental patient, his identification, control, treatment, and experiences within his family and community provide additional evidence of the effect of environmental factors upon behavior.
322. **Human Behavior and the Social Environment II.** 2 hr. In this course the objective is to increase understanding of social organizations and small groups as they develop, change, and affect behavior of those affiliated with them.
323. **Human Behavior and the Social Environment III.** 2 hr. An intensification of the understanding of behavior of individuals and of societies by the student is achieved through an intensive review of theoretical material that has been covered in courses S.W. 321 and S.W. 322. The knowledge is applied to experiences the student has had in his field work as well as to types of deviant behavior. Effort is made to achieve an integration with knowledge from other courses in order to appreciate the interrelationship of behavior of individuals, societal groups, and communities. Capable student may select projects which will help them extend their knowledge and its application upon which they work independently.

331. **Social Welfare Policy and Services I.** 3 hr. A critical analysis of the historical rise of social welfare policy in the western world plus the rise of the social work profession. An introductory understanding of the dynamics of policy formulation and social planning with particular reference to income maintenance.
332. **Social Welfare Policy and Services II.** 2 hr. A critical appraisal of the policies underlying the delivery of social services in various settings and fields of practice, both public and voluntary, with emphasis upon the need for new policy for new services.
333. **Social Welfare Policy and Services III.** 2 hr. Emphasis is placed upon the students' ability and skill in formulating policy procedure, social planning and social action, in relation to certain major social problems and issues as a change agent. Social problems are developed from the perspective of the students' interests and concerns.
341. **Social Work Management.** 3 hr. An intensive examination of the concepts, principles and skills of administration, consultation, supervision, and teaching in social work practice.
381. **Field Instruction I.** 5-14 hr. Field instruction and practice in selected settings under general direction of the faculty.
382. **Field Instruction II.** 5-14 hr.
388. **Seminar.** 1-6 hr. Intensive study in the student's area of special interest. Individual conferences with staff; guided reading program; preparation of an individual written report. Seminar meetings for all students supplement individual study.
396. **Special Topics.** 1-6 hr. Examination of selected issues in social work and social welfare.
397. **Research.** 1-15 hr. The first semester of the research sequence requires the student to learn the relationship and importance of social and behavioral science research to the practice of social work. The student learns the major steps of research: how to formulate problems for research, the use of hypotheses and theory as both research and professional tools, the basic elements of research design, and elementary, descriptive statistics. Learning experiences include lecture, discussion, demonstration, and readings in the professional literature. During the second semester, the student becomes familiar with actual methods of data collection, sampling procedures, and some of the simpler methods of inferential statistics used in hypothesis-testing research. Survey methods will be learned under actual field conditions as well as in lecture and laboratory experiences. During the last semester, the student may choose to complete a research project or participate in an advanced course.

Industrial Relations

A graduate program leading to a Master of Science Degree in the field of industrial relations is offered through the cooperation of the College of Commerce, the Department of Psychology, the Department of Sociology, and the Institute for Labor Studies.

Applicants for admission must have a baccalaureate degree from an accredited university or college with a minimum of 21 hours of undergraduate work in the social sciences, including at least 3 hours in statistics and 3 hours of labor economics. The social sciences are interpreted to include economics, history, political science, psychology, sociology, and general social science. In addition to the course requirements, applicants must have a 2.5 (based on 4.0) grade-point average in undergraduate work. Students who do not have the necessary undergraduate courses may be admitted as special students, but undergraduate deficiencies must be removed in the first semester of residence without graduate credit. All applicants should plan to take the Graduate Record Examination immediately. Any admission to the program will be considered tentative until Graduate Record Examination Scores are received.

To receive the master of science degree the candidate must complete 30 hours of graduate work which will include the following required courses. An average of 3.0 must be maintained in courses taken prior to thesis.

Economics 262—Collective Bargaining or Economics 261—Trade Unionism, 3 hr.

Psychology 203—Personnel Psychology, 3 hr.

Sociology 250—Human Relations in Industry, 3 hr.

Statistics 211—3 hr.

Industrial Relations 330—Seminar in Industrial Relations, 3 hr.

Industrial Relations 340—Thesis, 6 hr.

The remaining hours will be chosen from the following courses after consultation with the adviser. While the listed courses are preferred, considerable latitude may be given the student by his adviser to choose other courses which are particularly appropriate to his background and interest. Approval must be obtained in advance.

<i>Industrial Engineering</i>	<i>Hr.</i>	<i>Economics</i>	<i>Hr.</i>
240—Motion and Time Study	3	263—Economics of Wages	3
288—Job Eval. & Wage Incent.	2	211—Micro. Econ. Anal.	3
370—Theo. Ind. End. & Org.	3	212—Macro. Econ. Anal.	3
<i>Psychology</i>		390—Readings in Econ.	1-3
307—Prac. Indust. Interview	3	360—Adv. Labor Econ.	3
304—Leadership and Human Rel.	3	364—Seminar, Labor Econ.	3
309—Seminar in Indust. Psych.	2	<i>Law</i>	
213—Directed Studies	1-3	264—Labor Law	3
<i>Management</i>		<i>Sociology</i>	
216—Personnel Management	3	218—Economic Life	3
225—Business Policy	3	260—Complex Organizations	3
<i>Political Science</i>		<i>Rehabilitation Counseling</i>	
241—Adm. Org. and Man.	3	384—Occ. and Place.	3
346—Dr. Read. in Publ. Adm.	2-4		

The student's thesis must be prepared in conformity with the general regulations of the Graduate School. The final draft must be approved by the thesis committee, composed of the thesis chairman and two other faculty members. At least two of these committee members must be members of the Executive Committee of the Graduate Program in Industrial Relations.

Institute of Biological Sciences

The Institute of Biological Sciences, comprising the departments associated with the life sciences, offers advanced study and research on a disciplinary and interdisciplinary basis in areas of experimental biology ranging from the molecular to the population level. The staff of the institute includes a faculty of more than eighty Ph.D.'s encompassing nine departments located on the Downtown, Evansdale, and Medical Center campuses. Work toward the Ph.D. degree may be pursued in the basic botanical and zoological sciences, the agricultural sciences, or the medical sciences. All programs leading to the Ph.D. degree also offer the M.S. degree. There are a few additional programs which offer only the M.S. degree.

No rigid statement about academic requirements for graduate studies in the biological sciences can be made. Each department sets its own requirements, details of which should be obtained from the appropriate departmental chairman who are listed below along with the research activities of their departments. In general, students with good academic records and majoring in chemistry, biology, or the agricultural sciences are desirable applicants. All students should be adequately prepared in mathematics, biology, and chemistry, especially the latter. Potential graduate students are urged to take, during their senior year as undergraduates, the Graduate Record Examination, both the aptitude and advanced tests. It is advisable to prepare for the foreign language requirements for the Ph.D. degree by taking undergraduate courses in two languages, preferably French and German.

A general application form may be obtained from The Director, Institute of Biological Sciences, Room 1157 Basic Sciences Building, West Virginia University Medical Center. Inquiries concerning individual programs, financial assistance, departmental requirements, and professional career opportunities should be sent to the appropriate departmental chairman as listed below.

BOTANICAL AND ZOOLOGICAL SCIENCES

Biology: Dr. Jay Barton, 200 Brooks Hall.

Research Areas—Molecular biology: methyl transferase function, control of betacarotene synthesis, mechanisms of steroid actions in phycomycetes, biochemistry of plant hormones. Cellular biology: nuclear function and plant morphogenesis, the physiology and biochemistry of avian and mammalian germ cell, synchronized cell division, cytology, endocrine systems in reproduction. Organismic biology: plant physiology, plant and animal morphology, vertebrate morphogenesis, animal behavior, systematic and taxonomic studies of animal life of the Appalachian region, chemotaxonomy. Population biology: ecological systems and environmental stress, especially air and water pollutants, ecology of algae, fisheries biology, productivity of streams and reservoirs, vertebrate ecology and speciation, plant speciation, ecological taxonomy.

AGRICULTURAL SCIENCES

Faculty of Agricultural Biochemistry: Dr. George A. McLaren, 1046 Agricultural Sciences Building.

Research Areas: Enzymes, carbohydrates, lipids, proteins, nutritional biochemistry, plant biochemistry and biochemical genetics.

Agronomy and Genetics: Dr. Collins Veatch, 1090 Agricultural Sciences Building.

Crop Science: Field crop, forage and pasture production and management; crop rotation systems; cutting management, stand establishment and longevity of forages; weed control; low temperature hardiness, physiological effects of chemicals

on crop plants and weeds. Genetics: Immunogenetics of protein polymorphism and their biochemical basis; biochemical genetics of enzyme polymorphism; physiological-biochemical basis of heterosis; mechanisms of action of indoleacetic acid; molecular basis of development and differentiation; population genetics and inheritance of reproductive traits; radioprotective effect of alloxan and its mode of action; cytogenetic, cytotaxonomic and cytological studies in plants; freeze preservation of biological materials. Soil Science: Soil chemical properties and their interrelationships, characterization of soil phosphorus and organic nitrogen compounds; nutrient availability as related to soil structure, time and rate of potassium fertilization on crops; hydrology of watersheds on shale soils, factors relating to frost heaving, surface mine land reclamation; micronutrient availability; soil fertility; forest-soils relationships.

Animal and Veterinary Science: Dr. Marvin R. McClung, G-036 Agricultural Sciences Building.

Research Areas—Nutrition: Control of feed intake; nonprotein nitrogen metabolism; bacterial carbohydrate metabolism in ruminants. Physiology: Magnesium homeostasis; pituitary-ovarian relationships; dietary factors and thyroid function; sperm metabolism; breeding seasons and reproductive efficiency. Veterinary Pathology: Avian infectious synovitis; pathogenesis of uterine infection. Genetics and Breeding: Genetic and environmental factors in production of meat, milk and eggs; genetic effects of irradiation; evaluation of breeding systems. Food Science: Effects of environmental, genetic, and age differences on quality of meat, milk, and eggs.

Plant Pathology and Bacteriology: Dr. H. L. Barnett, 401 Brooks Hall.

Research Areas—Agricultural Bacteriology: Microbiology of streams and ponds; microbial decomposition in sanitary landfills; physiology of fungi; effects of light on fungi; mycoparasitism. Plant Pathology: Physiology of host-parasite relationships; late blight of potato and tomato; disease of field and forage crops; biology and control of plant parasitic nematodes; oak wilt; decay of hardwoods and wood products.

MEDICAL SCIENCES

Anatomy: Dr. Donald L. Kimmel, 4053 Basic Sciences Building, Medical Center.

Research Area—Gross Anatomy: Anatomical variations and anomalies, and electromyographic studies of specific muscle groups. Microscopic Anatomy: Studies of cells, tissues and organs, under normal and experimental conditions with histochemical, electron microscopic, autoradiographic, regenerative, and fluorescent techniques. Developmental Anatomy: Experimental and descriptive embryology, cellular differentiation, and dedifferentiation, organizers and the effects of different environments on development. Neuroanatomy: Experimental, comparative and embryological studies of specific nerve cell groups and nerve pathways in the spinal cord, brain stem, cerebellum and cerebrum.

Biochemistry: Dr. Reginald F. Krause, 3127 Basic Sciences Building, Medical Center.

Research Areas—Nutrition: Vitamin A and carotene metabolism. Enzymology: enzyme kinetics. Biological Transport: fatty acids and amino acids. Organic synthesis of biological compound: "sulfones." Immuno Chemistry: complement factors; antigen-antibody reactions. Genetics: biochemical defects in inherited diseases. Lipid Metabolism: artherosclerotic disease and cardiac hypertrophy. DNA and RNA metabolism in cancer cells.

Microbiology: Dr. John M. Slack, 2078 Basic Sciences Building, Medical Center.

Research Areas—Immunology: Studies on the mechanisms of antigen-antibody reactions and the development of hypersensitivity. Virology: Characterization of respiratory viruses using tissue cultures and fluorescent antibody techniques. Parasitology: Host-parasite relationships between various protozoa and insect of animal hosts. Physiology: Nutrition and metabolism of a variety of pathogenic microorganisms.

Genetics: Basic studies on the mechanisms of genetics including transformation of genetic information. Electron Microscopy: Cytological studies of the fine structures of microorganisms and the influence of environment on these structures.

Pharmacology: Dr. William W. Fleming, 3152 Basic Sciences Building, Medical Center.

Research Areas—Autonomic Pharmacology: autonomic regulation of the cardiovascular system and of smooth muscle; sensitivity to autonomic drugs; synthesis, release and metabolism of catecholamines; cholinesterase inhibitors. Chemotherapy: antimalarial agents, effects of chemotherapeutic agents on intestinal flora and fauna. Biochemical Pharmacology: drug metabolism; effects of drugs on lipid and nucleic acid metabolism. Endocrine Pharmacology: mechanism of action of steroids; metabolism of sex accessory tissues. Neuropharmacology: mechanism of action of anticonvulsants; neuromediators in the central nervous system. Toxicology: metabolism of toxic agents; tolerance to organophosphorus compounds.

Physiology and Biophysics: Dr. M. F. Wilson, 3055 Basic Sciences Building, Medical Center.

Research Areas—Cellular, membrane transport and electrical properties of excitable tissue; integrative and behavioral functions of the nervous system; regulation and dynamics of the circulation, respiration, endocrine, and electrolyte balance systems; theoretical and experimental biophysics; and biomedical instrumentation.

INTERDEPARTMENTAL PROGRAMS

Genetics and Developmental Biology Faculty: Dr. Richard C. Juberg, 4618 Basic Sciences Building, Medical Center.

Research Areas—Bacterial and viral genetics; cytogenetics; developmental genetics; differentiation; embryology; forest genetics; blood group genetics; human genetics and cytogenetics; mammalian genetics; molecular and biochemical genetics; morphogenesis; plant genetics; population genetics and statistics.

Plant Physiology Faculty: Dr. Morris Ingle, 2072 Agricultural Sciences Building.

Research Areas—Plant soil water relations; environmental physiology; micrometeorology; physiological effects of air and water pollution; tissue culture; cytokinins; auxins; morphogenesis; physiology and biochemistry of plant growth; physiology of cold hardness; post-harvest physiology; organic acid metabolism; polyphenol metabolism; physiology of chilling injury, role of boron and other micro-elements; herbicide physiology; fruit physiology.

Reproductive Physiology: Dr. E. K. Inskeep, G016 Agricultural Sciences Building.

Research Areas—Physiology of spermatozoa; fertility and viability of aged ova, regulation of the life span and function of the corpus luteum; effects of light and other environmental factors on reproduction; physiology of uterine contractions; dietary mineral levels and reproduction; endocrinology and metabolism; role of gonadotropic hormones in control of steroidogenesis; control of estrus and ovulation and use of artificial insemination in beef cattle, swine and sheep; and physiology of intrauterine contraceptive devices. The members of the Faculty of Reproductive Physiology and their research facilities are located in various departments: Anatomy; Animal Science; Biology; Genetics; Internal Medicine; and Obstetrics and Gynecology.

An Interdepartmental program is being developed in Bioengineering.

Further information regarding these programs may be obtained from the Director, IBS, Room 1157, Basic Sciences Building, West Virginia University Medical Center, Morgantown, W. Va. 26506.

Journalism

The School of Journalism offers work leading to the degree of Master of Science in Journalism. The purpose of the degree is to provide the student who already has a sound background in technical and professional journalism education an opportunity to broaden his communications horizons by gaining a critical insight into the theory and practice of the communications industries; the degree also is intended to introduce the student to research methods applicable to communications problems.

Admission. In order to be admitted to the Master of Science in Journalism program, the student must have a baccalaureate degree in journalism from an accredited institution or must have completed a core program in journalism or must demonstrate competency in a minimum number of areas prescribed by the School of Journalism. The prospective student also must have a 3.0 average in undergraduate Journalism courses.

Requirements. The student will be required to meet the following requirements for the degree:

- a. Complete a minimum of 30 semester hours, including a thesis with a maximum of 6 hours credit.
- b. At least 18 hours of work, including the thesis, must be taken in the School of Journalism.
- c. A minor of 9-12 hours credit must be taken outside the School of Journalism.

Examination. On completion of course requirements, the candidate shall be required to pass an oral examination on his thesis and on his competence in his major and minor fields.

201. **Interpreting Current Events.** I, II, S. 1 hr. This course emphasizes the sociological, ideological, historical, and political implications of current events. Conducted in a discussion format, it requires the student to relate news events to a framework of readings by authors from any appropriate period.
203. **Media Management and Promotion.** I, II, S. 3 hr. PR: Journ. 113 and 115. Problems, functions, and responsibilities in communications media organization, operation, management, and promotion. Special emphasis on case study of media management and promotion in the Appalachian area.
204. **Advertising Markets and Media.** I, II, S. 3 hr. PR: Journ. 113. A study of advertising planning, buying, and scheduling by advertisers, media, and advertising agencies on national and local levels. Seminar discussions and assignments with special emphasis on problems related to Appalachian markets and media.
210. **Advertising Production.** II. 3 hr. PR: Journ. 110. Techniques and mechanics of producing print advertising. Study includes art, typography, printing processes, layout and makeup. Student must acquire tools and supplies for lab work; cost: about \$10.00.
212. **Public Relations.** I, II, S. 3 hr. Open to all University students. This survey course introduces the student to the principles, problems, and practices of communication between an organization and its publics. The definition and historical development, the opportunities and challenges, the techniques and management of public relations are included. Written assignments include two book reports and typical PR communication projects—the promotional pamphlet, the executive speech, the news release, and others.
213. **Industrial and Technical Journalism.** II. 2 hr. Open to all University students; especially useful to engineering, agricultural and other technical disciplines. Emphasis is on technical writing (reports and proposals) and how it fits into the research and development arm of modern business practices.

215. **High School Journalism.** II, S. 2 hr. Open to all University students. A survey of scholastic publications and techniques; suggested methods of instruction.
220. **Newspaper and Magazine Article Writing.** I, II. 2 hr. Open to all University students. A seminar-type course devoted to the writing, editing, and marketing of features, including reviews and critical articles.
227. **History of Journalism.** I, S. 3 hr. PR: Hist. 52 and 53 or consent. Open to all University students. A study of the impact of the American press on the nation; the development of today's communications media from the beginnings in 17th century England and in the American colonies; an examination of the great names in journalism from the standpoint of their contributions to today's journalism; freedom of the press and its current implications.
228. **Law of the News Media.** II. 3 hr. For seniors and graduate students. A study of the law as it affects the mass media. Considered are such areas as libel, public records, criminal pre-trial publicity, freedom of information, obscenity.
230. **Editorial and Interpretive Writing.** I, II. 3 hr. Open to all University students. The student will analyze and write editorials and commentaries. He will study typical editorial pages and the ethics governing editorial page content. He will also become familiar with libel, privacy, contempt, and other problems—operating and political—as they arise.
239. **Seminar in Advertising Management Problems.** I. 2 hr. PR: Senior standing and major or minor in advertising. Current trends in advertising, merchandising, and distribution problems. Students develop individual projects in some phase of advertising or management.
241. **Journalism Problems.** I, II, S. 1-3 hr. For seniors and graduates. An intensive study, independently conducted, of a specialized area or problem in journalism; to be approved by the Dean.
242. **Advanced Journalism Problems.** I, II, S. 1-3 hr. A continuation of Journ. 241.
243. **International Communications.** I. 3 hr. International news gathering and dissemination—including wire services, broadcast satellites, and political barriers—will be examined, particularly as these factors affect a free exchange of information within the world community. Efforts by the United Nations to encourage news exchange and to lower news barriers will be a major case examination.
281. **Public Affairs Programming.** I. 3 hr. PR: Journalism 183 or consent. The basic principles of evaluating and documenting public issues into television and radio presentation form. Includes methods of program selection, research, writing, sources and type of content materials.
282. **Public Affairs Programming.** II. 3 hr. PR: Journ. 281. Continuation of Journ. 281. An in-depth laboratory course in actual preparation of materials for inclusion of public issues programs. Work includes filming and recording interviews, background materials, obtaining and selecting supporting sound, music, art.
286. **Radio and Television Advertising.** I. 3 hr. PR: Journ. 113 or Speech 184 and consent. Development of radio and television writing techniques. Media planning, buying and market analysis. Federal regulations affecting advertising in broadcast media.
289. **Documentary Motion Picture Production.** II. 3 hr. PR: Journ. 189 and Journ. 281 or Speech 184 or Speech 280. An in-depth development of the techniques and resources utilized in the production of a complete documentary motion picture. Areas of study include films, processing, cinematography, editing, research, writing, music, narration. Laboratory oriented. Laboratory fee.
301. **Research Methods and Literature.** I, S. 3 hr. A study of methods common to communications research; critical examination of communications literature;

the mass media; problems of communicating with the various publics; general independent research projects by each student.

302. **Seminar in Communications Theory. II, S. 3 hr.** Historical development of problems of contemporary mass media.
312. **Seminar in Institutional Relations. II. 3 hr.** A study of the problems of public relations and public information officers of educational institutions of higher learning and public service organizations; thorough study of the publics which these officers attempt to reach.
315. **Seminar in Journalism Education. I, S. 1-3 hr.** Discussion of journalism education problems. Each student will do an individual research project planned to provide for his professional development as a teacher of journalism. Emphasis on secondary school problems.
339. **Seminar in Advanced Advertising Management Problems. II. 3 hr.** Recently developed ideas and techniques in advertising, advertising research, and media management.
343. **Seminar in the Foreign Press. II. 3 hr.** Studies in legal and communications problems of the international flow of news and opinion; international press codes; communications media of major countries.
380. **Thesis. I, II, S. 2-6 hr.**
382. **Seminar in Public Affairs Broadcasting. I, II, S. 6 hr.** Investigation and discussion of current problems and practices in the field of broadcast journalism. The student and the instructor will choose a problem, or a phase of a problem, for analysis and research as the course progresses.

Medical Center

The Departments of Anatomy, Biochemistry, Microbiology, Pharmacology, and Physiology and Biophysics each offer programs of study leading to the Master of Science and the Doctor of Philosophy degrees. Admission to these programs is permitted only with approval of the department concerned. Students should contact the chairman of the major department and request permission to do graduate work well in advance of the time of registration.

REQUIREMENTS FOR ADMISSION

1. The student's undergraduate scholastic standing shall be a quality equivalent to that required for admission to the School of Medicine or School of Dentistry.
2. A transcript of the student's grades should be available to the major department at least six weeks before the beginning of the semester in which the student desires to start his graduate work. In addition, two letters of recommendation from professors in major and minor fields are desirable.
3. The students may be asked to appear in person.
4. The candidate must meet the admission requirements of the department in which he pursues his major study. Qualifying entrance examinations and/or the Graduate Record Examination may be required.
5. After acceptance and before registration, the student and his adviser shall formulate a schedule for the entire year.

STANDARDS FOR GRADUATE STUDY AND REQUIREMENTS FOR MASTER OF SCIENCE DEGREE

1. No credits are acceptable toward an advanced degree which are reported with a grade lower than "C." Certain departments require the student to maintain a "B" average or that two-thirds of the credits carry a grade of "B."
2. A minimum of 30 hours of related graduate courses shall be required. Twenty hours shall be in the major field which includes 6 hours credit for a thesis.
3. An examination in the major and related fields shall be given before the student can qualify for his final oral examination.
4. A thesis is required and shall represent original research by the candidate for the degree.

REQUIREMENTS FOR MASTER OF SCIENCE DEGREE FOR STUDENTS ENROLLED IN SCHOOL OF MEDICINE OR DENTISTRY

1. Medical or Dental students shall fulfill the above requirements for admission and scholarship.
2. Students enrolled in the Schools of Medicine or Dentistry who hold a Bachelor's degree from an approved institution and desire to do additional work for the Master's degree must also register in the Graduate School.
3. Medical and dental students may count preclinical courses in basic sciences toward the Master's degree as long as they complete not fewer than 24 semester hours of graduate courses that are not required for the degree of Doctor of Medicine or Doctor of Dental Surgery.
4. All courses offered to meet these requirements must be courses numbered between 200 and 399 that are approved by the Graduate School and listed in this bulletin.
5. A thesis is required.

REQUIREMENTS FOR DOCTOR OF PHILOSOPHY DEGREE

1. The student must meet the standards of scholarship required for the Master's degree and complete or offer previous graduate credit of no less than 60 semester hours of related course work, exclusive of research or thesis. However, these 60 semester hours may include 6 hours of research or thesis credit earned for the Master's degree.

2. The residence requirements set by the Graduate School for the degree of Doctor of Philosophy must be met.

3. Students will be required to take a comprehensive preliminary or qualifying examination, language examinations, and a final examination as specified by the regulations of the Graduate School. Arrangements must be made with the major department which will determine the scope and nature (either oral or written or both) of these examinations. Also, the major department may request the Dean of the Graduate School to approve the substitution for French, German, or Russian of a more suitable foreign language.

4. Before admission to the final examination, the candidate must submit a thesis that presents the results of the candidate's individual investigation, demonstrates a mastery of research techniques, and represents a definite contribution to knowledge.

REQUIREMENTS FOR MASTER OF SCIENCE DEGREE FOR STUDENTS WHO ARE DOCTORS OF MEDICINE OR DENTAL SURGERY

1. Such students must meet the standards of scholarship required for the Master's degree and complete not less than 30 semester hours of course work, exclusive of research or thesis, beyond that required for the professional degree.

2. The requirements, cited for the Doctor of Philosophy Degree, concerning examinations and thesis must be met.

MEDICAL CENTER COURSES OPEN TO GRADUATE STUDENTS

Anatomy

- 201. **Gross Anatomy of the Trunk.** (With Medical Students). I. 5 hr. PR: Consent. A detailed study of the human body with a complete dissection.
- 202. **Gross Anatomy of Head and Neck.** II. 3 hr. PR: Consent.
- 204. **Gross Anatomy of the Extremities.** II. 2 hr. PR: Consent.
- 205. **Microanatomy and Organology.** (With Medical Students). I. 6 hr. PR: General zool. or equiv. and consent. Structure, function, and embryology of tissues and organs.
- 206. **Gross Anatomy.** (With Dental Students). I and II. 8 hr. PR: General zool. and consent. A study of the human body including dissection.
- 208. **Neuroanatomy.** (With Dental Students). II. 2 hr. PR: Consent. A gross and microscopic study of the central nervous system. (See also Conjoined Course 275.)
- 209. **Microanatomy and Organology.** (With Dental Students). I. 6 hr. PR: General zool. and consent. Structure, function, and embryology of tissues and organs with emphasis on teeth and supporting structures.
- 301. **Advanced Gross Anatomy.** I, II. 2-6 hr. per sem. PR: Anat. 201, 202, 204, and consent. A morphological and functional analysis of selected regions. With dissection.

302. **Advanced Developmental Anatomy.** I, II. 2-6 hr. per sem. PR: Anat. 201, 202, 204, and consent. Detailed developmental anatomy of the fetal period and childhood. With dissections and analysis of variations and malformations.
303. **Seminar in Anatomy.** I, II. 1 hr. per sem. Course may be repeated. PR: Consent. Presentation and discussion of special topics of current or historical interest.
304. **Applied Anatomy.** I, II. 2-6 hr. per sem. PR: Consent. Detailed study of anatomy adapted to the needs of the advanced student.
305. **Experimental Embryology.** II. 3 hr. PR: Embryology and cellular physiology or biochemistry and consent. An analysis of development, differentiation, and regeneration.
306. **Advanced Neuroanatomy.** I. 2-4 hr. per sem. PR: Conjoined Course 275 and consent. A detailed study of selected areas of the brain and spinal cord. Offered in alternate years.
307. **Advanced Study of the Autonomic Nervous System.** I. 2-4 hr. per sem. PR: Conjoined Course 275 and consent. Special topics on the peripheral autonomic nervous system and central areas of integration. Offered in alternate years.
351. **Advanced Microanatomy and Organology.** I, II. 2 hr. PR: Microanat. 205 or 209 and consent. An extension of the major topics included in Microanat. 205 or 209 with special emphasis on recent contributions.
397. **Research in Anatomy.** I, II, S. 1-15 hr. PR: Consent. Course may be repeated as needed with the consent of the Graduate Committee.

Biochemistry

231. **General Biochemistry.** II. 4-7 hr. PR: Inorganic Chem., Organic Chem., and consent.
 - A. Lectures and conferences—4 hr.
 - B. Laboratory, demonstration and conference for Medical, Dental and Graduate Students—3 hr.
239. **Clinical Chemical Techniques.** (Primarily for Medical Technology Students). II. 4 hr. PR: Biochem. 139, 231 or equiv. Open to other qualified students.
305. **Lipid Biochemistry.** I. 3 hr. PR: Agr. Biochem. 291 or Med. Biochem. 231, and consent. A consideration of the chemical and physical properties of the various classes of lipids and their biochemical and physiological pathways within the cell and cellular particulates. Offered in even years.
323. **Biochemistry of the Immune Globulins and Related Proteins.** I. 2 hr. PR: Biochem. 231. A study of the biosynthesis, chemistry, and biological properties of proteins important in immunology. Offered in 1970-71 and alternate years.
330. **Biochemical Preparations.** I, II, S. 2-5 hr. PR: Biochem. 231 or equiv., consent. Emphasis on biochemical methods.
332. **Enzyme Kinetics.** II. 3 hr. PR: Biochem. 139, 231, or equiv., consent. An introduction to the physical mechanisms of enzyme action.
334. **Special Topics.** I, II, S. 1-18 hr. PR: Consent.
337. **Biochemistry of the Amino Acids and Proteins.** I. 3 hr. PR: Biochem. 231 or equiv., consent. Offered in 1969-70 and every second year.
339. **Seminar in Biochemistry.** I, II, S. 1-6 hr. (1 hr. per sem.) PR: Biochem. 231 or equiv., consent. Presentation and discussion of special topics.
397. **Research in Biochemistry.** I, II, S. 1-15 hr.

Medicine

223. **History of Medicine.** (With Medical Students). I. 1 hr. A brief history of the development of the art and science of medicine.

Microbiology

220. **Microbiology.** (For Pharmacy and Medical Technology Students). II. 5 hr. PR or Conc.: Organic Chem. A detailed study of pathogenic microorganisms.
221. **Microbiology.** (For Second Year Medical Students and Graduate Students). I. 4-7 hr. (4 hr. for Graduate Students taking only the lectures). PR: Organic Chem., Biochem. A detailed study of pathogenic microorganisms.
222. **Parasitology.** (For Medical Students, Second Year). II. 2 hr. PR: Consent. Introduction to animal organisms as human pathogens and vectors of disease.
224. **Parasitology.** (For Medical Technology and Graduate Students). II. 4 hr. PR: Consent. Study of animal parasites and vectors of disease.
225. **Microbiology.** (For Dental Students). I. 5 hr. PR: Organic Chem. A detailed study of pathogenic microorganisms with emphasis on oral flora.
226. **Basic Microbiology.** (For Graduate Students). I. 4 hr. PR: Organic Chem.: Biology recommended; consent. A detailed review of the major groups of microorganisms including morphology and physiology.
227. **Special Problems in Microbiology.** I, II, S. 1-6 hr. per sem. with a total of 24 hr. available. PR: Microbiol. 225 or equiv.
228. **Diagnostic or Determinative Microbiology.** I, II, S. 1-6 hr. per sem. with a total of 24 hr. available. PR: Microbiol. 226 or equiv. Diagnostic procedures as aids to diagnosis of human diseases and methods for the identification of microorganisms.
319. **Comparative Cytology.** II. 4 hr. PR: Microbiol. 320; Consent as enrollment is limited. Basic features in structure and function of animal, plant, and microbial cells and their organelles. Projects in electron microscopy. Spring of 1970.
320. **Electron Microscopy.** I. 2 hr. PR: Consent as enrollment is limited. Introduction to preparation techniques. Operation of the electron microscope. Fall of 1969.
321. **Bacterial Physiology.** I. 3-4 hr. (lect. 3 hr. with lab. 4 hr.) PR: Microbiol. 226 or equiv.; Organic Chem.; Biochem. or Conc. Physiological studies on bacteria including nutrition, metabolic pathways, growth and death.
322. **Microbial Genetics.** II. 4 hr. PR: Microbiol. 226 or equiv., consent. This course describes microbial mutation and adaptation, bacterial gene transfer mechanisms, and cytoplasmic inheritance.
323. **Immunology.** II. 4 hr. PR: Microbiol. 226 or equiv. A thorough study of antigens, antibodies and their reactions both in vitro and in vivo with emphasis on theoretical and experimental problems.
324. **Virology.** II. 4 hr. PR: Microbiol. 226 or equiv. Biochemistry. A comprehensive study of the basic biology of human, animal and bacterial viruses.
325. **Medical Mycology.** I. 3 hr. PR: Microbiol. 226 or equiv.; Mycology 203 and 330 are recommended. A study of the fungi which infect humans with the emphasis on isolation and identification.
326. **Seminar.** I, II, S. 1-6 hr. PR: Microbiol. 226 or equiv. This will include the history of microbiology.
397. **Research in Microbiology.** I, II, S. 1-15 hr. per sem. Students may enroll more than once. PR: Microbiol. 226 or equiv.

Pathology

- 228. **Pathology.** (With Dental Students). II. 4 hr. PR: Consent. Microscopic Anat. 209. A study of disease processes with emphasis upon fundamentals.
- 251. **General Pathology.** Yr. 17 hr. PR: Consent. Includes gross and microscopic studies with demonstrations. (Note: Appropriate materials in Clinical Pathology are integrated in Path. 251).
- 253. **Oral Pathology.** I. 3 hr. A study of the etiology of the diseases of the teeth and their investing structures.
- 256. **Advanced Pathology.** I, II. 3 hr. PR: Consent, Path. 228. Microscopic and gross specimens from selected autopsies.
- 397. **Research.** I, II. 1-15 hr. PR: Consent.

Pharmacology

- 260. **Pharmacology.** (For Dental Students). I. 4 hr. PR: Physiology. Lecture and laboratory work dealing with the pharmacologic actions and therapeutic uses of drugs.
- 261. **Pharmacology.** (For Pharmacy Students). I. 5 hr. PR: Physiology. Lecture and laboratory course dealing with the principles, clinical applications, and laboratory methods in pharmacology.
- 262. **Pharmacology.** (For Medical Students, Second Year). II. 6 hr. PR: Physiology. Lecture-conference-laboratory course covering the general principles, pharmacodynamic actions, and therapeutic applications of clinically useful drugs.
- 263. **Toxicology.** II. 1 hr. PR: Consent. A study of the toxicological effects of official and non-official drugs and other harmful agents with special emphasis on symptomatology and treatment of the effects of economic poisons.
- 360. **Special Topics in Pharmacology.** I, II, S. 1-6 hr. per sem. Assigned study in pharmacodynamics, autonomic and cardiovascular pharmacology, chemotherapy, bioassay, and the biochemistry of drug action.
- 361. **Advanced Pharmacology.** I. 1-6 hr. PR: Pharmacol. 262 or equiv. Advanced lecture and laboratory study in specialized areas of pharmacology.
- 362. **Advanced Pharmacology.** II. 1-6 hr. PR: Pharmacol. 262 or equiv. Advanced lecture and laboratory study in specialized areas of pharmacology.
- 365. **Seminar in Pharmacology.** I, II. 1 hr. per sem. PR or conc.: Pharmacol. 262 or graduate status in basic medical sciences.
- 366. **Literature Survey.** I, II. 1 hr. per sem. Discussion of current literature pertinent to the field of pharmacology.
- 367. **Preceptorship.** (For advanced graduate students in pharmacology). I, II. 1-2 hr. per sem. Supervised teaching of pharmacology.
- 397. **Research in Pharmacology.** I, II, S. 1-15 hr. per sem. PR: Pharmacol. 262 or equiv.

Physiology and Biophysics

- 242. **Principles of Endocrine System.** I or II. 4 hr. PR: Consent. Lecture-conference analysis of recent literature: control systems, hormonal actions on molecular processes, with design and completion of laboratory experiment. 3 lect-conf., 1 lab.
- 243. **Fundamentals of Physiology.** (Dental and Graduate Students). I. 5 hr. PR: College physics, algebra and chemistry. Analysis of basic facts and concepts relating to cellular processes, organ systems and their control. Common lecture with Physiology 245. 3 lect., 1 conf., 1 lab.

244. **Introduction to Biophysics.** S. 3 hr. PR: General physics and calculus or consent. The theory and practical application of electronic fundamentals in modern research instrumentation. 2 lect., 1 lab.
245. **Medical Physiology.** (Medical and Graduate Students). II. 6 hr. PR: College physics, algebra, and chemistry. Analysis of basic facts and concepts relating to cellular processes, organ systems and their control, with clinical correlations. 3 lect., 1 conf., 2 lab.
246. **Neurophysiology.** II. 3 hr. PR: Physiol. 243 or 245 or consent. Synaptic transmission, reflexes and central nervous system function, and behavior.
340. **Special Topics.** I, II, S. 1-4 hr. per sem. PR: Consent. Assigned study designed to develop research skills.
341. **Physiological Methods.** I, II. 4 hr. PR: Grad. Physiol. and E.E. 210 or equiv. Theory and application of techniques essential to acquisition and processing of physiological data. 2 lect., 2 conf.-lab.
342. **Advanced Physiology.** I, II. 1-6 hr. per sem. PR: Math. 116 (Calculus II), and Physiology 245. Lecture-seminar in physiological and biophysical topics with emphasis on recent and quantitative developments.
344. **Graduate Seminar.** I, II. 1-6 hr. per sem. PR: Graduate status and consent.
345. **Biophysical Analysis.** II. 4 hr. (Alternate years). PR: Math. 117 (Calculus III), and Physiol. 245. Application of mathematical and biophysical theory to the study of cellular, organ and organismal functions. 3 lect., 1 conf.-seminar.
347. **Systems Biophysics.** II. 4 hr. (Alternate years). PR: Physiol. 345. A quantitative analysis of physiological regulatory systems. 2 lect., 2 conf.-seminar.
397. **Research in Physiology.** I, II, S. 1-15 hr.

Conjoined Basic Science Courses

(In the curricula of the Basic Sciences in the Medical Center, certain courses are conducted on non-departmental or interdepartmental lines. These have been designed as conjoined courses.)

214. **Medical Human Growth and Development.** (Medical and Graduate Students). II. 1 hr. PR: Consent. Basic considerations of embryology, organogenesis, teratology, and other factors influencing intrauterine growth and development and the adaptation of the fetus to extrauterine life.
221. **Medical Statistics.** (Medical and Graduate Students). I. 1 hr. PR: Consent. An introduction to the statistical analysis of biologic phenomenon as related to medicine.
270. **Medical Genetics.** (Medical and Graduate Students). II. 1 hr. PR: Consent. An introduction to the understanding of genetics and heritable disease in man.
275. **Neurobiology.** (Medical and Graduate Students). II. 6 hr. PR: Anatomy 201 and Physiology 245, or consent. A study of the anatomy and physiology of the nervous system correlated with clinical neurology.

SCHOOL OF DENTISTRY

The School of Dentistry and its Department of Orthodontics offer a program of advanced study and clinical training leading to the Master of Science degree with a major in orthodontics. The program requires a minimum of 24 months of full-time residency in the School of Dentistry, and is designed to qualify dentists for careers in orthodontic clinical practice, teaching, and research.

Inquiries concerning this program should be directed to the Department of Orthodontics or the office of the Dean of Dentistry. Applications will be processed in the School of Dentistry and applicants will be recommended to the Graduate School for admission.

REQUIREMENTS FOR ADMISSION TO ORTHODONTIC PROGRAM

1. Graduation from an accredited dental school.
2. Evidence of scholastic and clinical achievement that would indicate the applicant's ability to progress in a program of this nature.
3. Each applicant must file with the department all information requested in the department application form.
4. The applicant must be approved by the chairman of the department and the Dean of the School of Dentistry.

REQUIREMENTS FOR MASTER OF SCIENCE DEGREE FOR STUDENTS ENROLLED IN ORTHODONTIC PROGRAM OF SCHOOL OF DENTISTRY

1. General fulfillment of requirements of the Graduate School.
2. Twenty-four months of consecutive residency at the School of Dentistry.
3. Must pass an oral examination by a special committee selected by the adviser, the department chairman, and the Dean of the School of Dentistry.
4. An approved Master's thesis based on original research in an area related to orthodontics.
5. Candidates must complete a minimum of 66 credit hours. These include 49 hours of orthodontic courses, a minimum of 9 hours of selected basic science subjects, and a minimum of 8 hours of elective allied subjects.
6. Must have demonstrated satisfactory clinical competence in his field.
7. Must have maintained a grade level commensurate with graduate education.

Orthodontics

316. **Biomechanics.** I, II, S. 2 hr. PR: Consent. A study of the design and function of the teeth and their surrounding structures, and the response of these tissues to orthodontic procedures.
317. **Orthodontic Technique.** I, II, S. 2 hr. PR: Consent. A laboratory course in the techniques related to the fabrication and manipulation of orthodontic appliances.
318. **Orthodontic Materials.** I, II, S. 1 hr. PR: Consent. A study of the physical properties of the materials used in orthodontic appliances.
319. **Orthodontic Diagnosis.** I, II, S. 1-3 hr. PR: Consent. A seminar type class on the technique of patient examination, acquiring diagnostic records, and analyzing and correlating this information to the treatment of clinical problems.
320. **Cephalometrics.** I, II, S. 1-3 hr. PR: Consent. The use of radiographic cephalometry in studying growth of the human face, analysis of dento-facial malformations, and evaluation of orthodontic treatment.

321. **Orthodontic Mechanics.** I, II, S. 1-4 hr. PR: Biomechanics 316 and Orthodontic Technique 317. A seminar and laboratory course on basic orthodontic mechanical principles.
322. **Advanced Orthodontic Mechanics.** I, II, S. 1 hr. PR: Orthodontic Mechanics 321. A continuation of Orthodontic Mechanics 321 involving more difficult type cases and introducing more sophisticated appliance therapy.
323. **Growth and Development.** I, II, S. 1-5 hr. PR: Consent. A seminar type course on the normal and abnormal growth of the human head and its application to the field of orthodontics.
325. **Orthodontic Seminar.** I, II, S. 1-8 hr. PR: Consent. Discussions involving all branches of dental science, but with special emphasis on the orthodontic interest. Assigned topics and articles in the literature are discussed.
326. **Orthodontic Clinic.** I, II, S. 1-12 hr. PR: Biomechanics 316 and Orthodontic Technique 317. Clinical treatment of selected patients.
397. **Research in Orthodontics.** I, II, S. 1-8 hr. PR: Consent. Advanced research or special investigation of some topic related to orthodontics with a thorough survey of the past literature in the subject.

SCHOOL OF PHARMACY

The School of Pharmacy offers programs of graduate study leading to the degree of Master of Science in the Pharmaceutical Sciences. Students may specialize in pharmaceutics, pharmacy administration, pharmacognosy, pharmaceutical chemistry (organic-medicinal or pharmaceutical analytical), or pharmacy.

ADMISSION

Applicants for admission to the program must satisfy the general requirements for admission to the Graduate School of West Virginia University. Beyond this, the applicant should possess a B.S. degree with a minimum overall average of 2.75. In exceptional cases, students with course deficiencies or with a grade-point average below 2.75 may be admitted as a special graduate student. The record of the student will be reviewed at the end of 12 hours, and he may be allowed to pursue a degree program upon removal of any deficiencies and/or demonstration of ability to perform satisfactorily in the graduate program.

ACADEMIC STANDARDS

No credits are acceptable toward a graduate degree which are reported with a grade lower than a "C".

The graduate student must have a cumulative grade-point average of at least 3.0 in all graduate courses to qualify for the degree.

REQUIREMENTS FOR COMPLETION OF DEGREE

Upon acceptance to the program, the student will select his major adviser who will also serve as chairman of his advisory committee, his examination committee, and his thesis supervisor. The advisory committee will approve a plan of study and a research project for the thesis requirement.

To be eligible for the degree, the student must complete a minimum of 30 hours of graduate credit, of which, no more than 6 hours may be for research and thesis.

Upon completion of the course work and research requirements, and after submission of the thesis, an oral examination will be administered by the appointed examination committee.

Further information may be obtained by writing to the Dean, School of Pharmacy, West Virginia University, Morgantown, W. Va. 26506.

Pharmaceutics

300. **Industrial Pharmaceutics.** 4 hr. An introduction to the manufacture of dosage forms and their quality control. The structure of the industry and governmental influences are included. Special attention is given to new drug evaluation with regard to safety and efficacy. 2 hr. lect., 2 hr. lab.
301. **Advanced Pharmaceutics.** 3 hr. An advanced study of the physico-chemical and biopharmaceutical principles involved in homogeneous systems (solutions) which function as dosage forms. Included are considerations of kinetic processes of solution, stability, complexation, solubility, the pharmacokinetics within the body, adjuncts of palatability, etc. 3 hr. lect.
302. **Advanced Pharmaceutics.** 3 hr. An advanced study of the physicochemical and biopharmaceutical principles involved in disperse systems (liquid, semi-solid and solid) which function as dosage forms. Included are considerations of the properties of solid dispersions, micromeritics, diffusion of liquid dispersions, interfacial phenomena, emulsification, suspensions, prolonged action medication, etc. 3 hr. lect.

Pharmacy Administration

320. **Drug Regulation and Control.** 3 hr. A detailed study of legislation affecting the development, introduction, control, and utilization of drugs in the American economy. 3 hr. lect.
321. **Drug Distribution Systems.** 3 hr. A detailed study and analysis of drug distribution in institutional environments. 3 hr. lect.
323. **Economics of the Pharmaceutical Industry.** 3 hr. The history, background, and formation of major drug industries. Topics include oligopolistic practices, mergers, combines, costs of research, and production. 3 hr. lect.

Pharmacognosy

240. **Pharmacognosy.** II. 6 hr. PR: Consent. A study of drugs of biological origin, both plant and animal; their specific origins, methods of preparation, active constituents, and medicinal and pharmaceutical uses. Examples of the methods used in the isolation and study of such products are presented in the laboratory. 5 hr. lect., 1 hr. lab.
340. **Organic Plant Constituents.** 3 hr. A survey of the occurrence, properties, biogenesis, etc. of a number of classes of organic compounds derived from plants. Emphasis will be placed on those classes of secondary metabolites which contain products of pharmaceutical or medicinal interest. 3 hr. lect.
341. **Isolation of Plant Constituents.** 3-5 hr. A course designed to acquaint the student with techniques used in the extraction, separation, and isolation of plant constituents. 1 hr. lect., 2-4 hr. lab.

Pharmaceutical Chemistry

272. **Organic Pharmaceutical Chemistry.** I. 3 hr. PR: Consent. A study of synthetic drugs and certain natural drug products, with regard to nomenclature, synthesis and therapeutic, physical and chemical properties. 3 hr. lect.

273. **Organic Medicinal Chemistry. II.** 3 hr. PR: Consent. A continuation of Ph.Ch. 272 with special attention given to structure-activity relationship. 3 hr. lect.
274. **Pharmaceutical Analysis. I.** 4 hr. PR: Consent. Application of basic scientific principles to the quality control of drugs and dosage forms, with particular attention to newer analytical techniques. 2 hr. lect., 2 hr. lab.
370. **The Synthesis of Drugs.** 4-5 hr. A course embodying the design of drug molecules on the basis of structure-activity relationships and approaches to the synthesis of such compounds. Laboratory to accompany in which representative types of biologically active compounds are prepared. 3 hr. lect., 1-2 hr. lab.
375. **Advanced Pharmaceutical Analysis.** 3 hr. An overview of methods of spectroscopic methods of analysis with emphasis on their applications in pharmaceutical problems and in the biological sciences. 2 hr. lect., 1 hr. lab.
376. **Advanced Pharmaceutical Analysis.** 3 hr. A continuation of Ph.Ch. 375, with emphasis on electro analytical methods and the preparation of samples from pharmaceutical dosage forms and from biological materials. 2 hr. lect., 1 hr. lab.
377. **Advanced Pharmaceutical Analysis.** 3 hr. A study of the physical-chemical principles involved in methods development. A special problem is assigned as an integral part of the course. 1 hr. lect., 2 hr. lab.

Pharmacy

390. **Special Problems in Pharmaceutical Sciences.** 1-3 hr. Where special interest is shown by the student in an area other than that of his thesis research, a faculty member will supervise individual study and research. 1-3 hr. lab.
391. **Seminar in Pharmaceutical Sciences.** 1 hr. Presentation and discussion of special topics and research in the pharmaceutical sciences.
397. **Research.** 1-15 hr.

Physical Education

ADMISSION

Students who wish to enter the Graduate School file application for admission with the Director of Admissions of the University. The applicant must request the registrar of the college or university previously attended to send an official transcript directly to the Director of Admissions at least one month in advance of registration days. Application forms may be obtained from the Director of Admissions of the University.

Admission to Graduate School does not constitute admission to candidacy for the Master of Science degree. The Chairman of Graduate Studies in the School of Physical Education will advise the student concerning departmental prerequisites and advanced degree requirements. All entering graduate students must take the Graduate Record Examination General Aptitude test.

THE DEGREE OF MASTER OF SCIENCE

The School of Physical Education offers courses leading to the Master of Science degree, with an emphasis in Physical Education or Safety Education.

Students are admitted for graduate work leading to the M.S. Degree in the School of Physical Education, provided they hold a baccalaureate degree from an approved college; have a 2.5 undergraduate grade-point average (based on a 4-point system); and satisfy prerequisites in the courses for which they register.

Students who do not meet the 2.5 grade-point average requirement may be admitted on probation and will be required to earn a 3.0 average in the first 12 semester hours of residence work in order to continue.

Students are accepted as advanced degree candidates on the basis of a preliminary qualifying examination following one semester, or two summer terms, (12 semester hours)* of graduate residence work provided they:

A. Are certified to teach physical education; or have at least 24 semester hours, or its equivalent** which is an undergraduate minor in physical education. The equivalent is determined by the Committee on Graduate Courses.

B. Are certified to teach safety education; or have a baccalaureate degree from an approved college, declare an interest in pursuing graduate study in safety education; and receive permission from the Chairman of Graduate Studies in the School of Physical Education to pursue study in safety education.

C. Demonstrate to the satisfaction of the Committee on Graduate Study by a Preliminary Comprehensive Examination, taken after completing 12 hours in residence, a grasp of the important phases and problems in the major interest area.

Thirty-six semester hours are required for the Master of Science degree, distributed as follows:

- I. A *minimum* of 24 semester hours of approved courses in the School of Physical Education.
- II. A *minimum* of 6 semester hours of approved course work in academic areas other than course work offered by the School of Physical Education.
- III. Six semester hours may be earned for the writing of a thesis; or 3 semester hours may be earned for the writing of a problem.

*Courses taken in University Extension are accepted for degree purposes provided the student has had prior approval from his adviser.

**Experience in teaching Physical Education and Safety Education and coaching experience may be evaluated by special examination to adjust some of the undergraduate requirements.

- IV. A minimum of 12 semester hours must be in courses numbered 300 and above, 9 of which must be in the major interest area.
- V. Degree candidates must have a 3.00 grade-point average for graduation.
- VI. Degree candidates must successfully pass the comprehensive examination which will include philosophy in the major interest area; measurement and evaluation; and research methodology.
- VII. Degree requirements must be completed within 7 years from time of original matriculation.

CERTIFICATE OF ADVANCED STUDY PROGRAM

The program, in cooperation with the College of Human Resources and Education, is designed to prepare school and related personnel who wish professional training beyond the Master's degree. Candidates for this Certificate may choose from among the following areas of study for their specialization: Physical Education and Safety Education.

Prerequisites for Admission to the Program

1. General requirements for admission to the Graduate School of West Virginia University.
2. A Master's degree with a grade-point average of 3.0 or higher.
3. A minimum of three years of teaching or closely related educational experience.

Requirements for Admission to Candidacy

1. Evidence through examination, personal letter, and personal interview of general proficiency, acceptable standards of oral and written communication, and good health.
2. Satisfactory completion *in residence* at West Virginia University of at least six semester hours of approved course work beyond the conferring of the Master's degree.

Requirements for Completion

The Program: An approved program consisting of a minimum of 30 semester hours earned above the Master's degree of which 24 semester hours will be course work in Education and closely related fields of 6 hours of research.

At least 24 semester hours of the work credited for this Certificate must be done in residence at West Virginia University. This requirement includes the 6 hours of research which may be conducted apart from the physical limits of the University but must be done under the direction and supervision of the chairman of the student's graduate committee. A maximum of 6 semester hours earned in residence at another approved graduate institution or in West Virginia University Extension may, if approved by the student's adviser, be allowed toward credit for the Certificate.

Final Examination: Upon completion of all requirements including the research report, the candidate will be admitted to a final oral examination by his graduate committee.

Time Limitation: All requirements must be completed within seven calendar years immediately preceding the awarding of the Certificate.

THE DEGREE OF DOCTOR OF EDUCATION

The degree of Doctor of Education is offered in cooperation with the College of Human Resources and Education. Admission to the Graduate School and enrollment in graduate courses do not themselves imply acceptance of the applicant for a Doctor of Education degree.

Admission. Individuals who wish to pursue a program leading to the Doctor of Education degree must be admitted to the Graduate School of West Virginia University. All applicants for admission to the doctoral program must submit scores on the Aptitude Test of the Graduate Record Examination and otherwise comply with each of the General Regulations of the Graduate School outlined in Part I and Part II of this Graduate School bulletin. Acceptance for study toward the doctoral degree in a specific area of concentration will be based on prior academic achievement including a cumulative grade-point average of 3.0 or above and a satisfactory score on the general aptitude test of the Graduate Record Examination or other appropriate measure of academic aptitude and an interview by the Doctoral Admissions Committee during the Preliminary Examination. Students having a cumulative grade-point average of less than 3.0 but having a satisfactory score on the Graduate Record Examination or other appropriate measure of academic aptitude may be admitted provisionally; final acceptance will be contingent upon the results of the Preliminary Examination. Students who meet the standards for admission set forth by the various programs will be assigned a temporary adviser.

Preliminary Examination. The student must make application through his temporary adviser to the Chairman of Graduate Studies to take the Preliminary Examination. Usually, the examination is taken after tentative admission to the program and completion of six to twelve hours of doctoral work at West Virginia University. A maximum of eighteen (18) hours credit or doctoral work completed at West Virginia University prior to the preliminary examination may be counted.

The purposes of the preliminary examination are to discuss with the student his proposed areas of doctoral study, and to make appropriate recommendations concerning his acceptance into an area of concentration and acceptability of prior work to meet program requirements.

The composition of the preliminary examining committee shall include, at least, the Chairman of Graduate Studies, the coordinator of major program, the coordinator(s) of minor program(s), and the student's temporary adviser. Prior academic achievement, professional experiences, test results, and other evidences of competence in areas essential for successful completion of the Doctor of Education Degree will be taken into consideration.

Doctoral Committee. Having received an affirmative recommendation from the preliminary examination committee to continue doctoral work, a permanent adviser to serve as the student's chairman of the doctoral committee will be selected by the Dean, Director of the Division, and the Coordinator of the Major Program. At least four additional committee members will be selected by the permanent adviser and student.

Curriculum. The final determination of the program of course work and research is the responsibility of the student's doctoral committee. The Doctor of Education degree is not awarded on the basis of the completion of any set number of credits but is awarded on the basis of demonstrated academic achievement and scholarly competence. The minimum course work shall be 70 semester hours of graduate work, excluding dissertation credit but including credits of relevant graduate work completed at the master's degree level. A minimum of 24 of the 70 semester hours shall be in the area of major concentration and a minimum of 24 of the 70 semester hours from a minor area of concentration in a supporting or related discipline.

Candidates having previously earned a graduate degree from West Virginia University will be required to earn credit while in residence at another graduate institution offering the doctorate in the student's major field. The student's doctoral committee shall approve the institution and the course work. In every case, a minimum of two semesters in residence at West Virginia University as a full-time doctoral student will be required. Requirements for the Doctor of Education degree must be completed within seven years after successful completion of the preliminary examination.

Admission to Candidacy Examination. The purposes of the admission to candidacy examination are to assess the quality of the student's academic achievement, to review the student's program of course work, to approve a proposed outline of dissertation research, and to admit the student to formal candidacy for the degree.

The examination may be taken after at least two-thirds of the student's program of course work has been completed but prior to the dissertation phase of the program. The admission to candidacy examination consists of two parts: (a) a written examination, and (b) an oral examination. The candidate must pass the written examination prior to taking the oral portion. The written examination will include a common "foundations" section (history and philosophy of education, research design and statistics, social and psychological foundations) and specifically prepared written examinations in the major area of concentration and in the area of concentration in the supporting discipline. The written examination may be repeated one time and, upon consent of the Dean, Director of Division and Coordinator of Major Program may be repeated a second and third time. At least six months must elapse between repeated examinations.

The oral portion of the admission to candidacy examination will be administered by the student's doctoral committee at the call of and under the direction of the committee chairman after successful completion of written portion of the examination. The oral portion of the examination may be repeated one time and, on recommendation of the doctoral committee, may be repeated a second time. At least six months must elapse between repeated examinations. On successful completion of the admission to candidacy examination, the student will be admitted to formal candidacy for the doctoral degree.

Dissertation. The candidate must submit and justify an outline or a prospectus for his doctoral dissertation at the oral portion of the admission to candidacy examination. The doctoral committee must review and *approve*, *approve with change*, or *reject* this outline or prospectus. The student shall systematically consult with members of the doctoral committee and with other appropriate members of the University faculty during the dissertation phases of his program.

Final Oral Examination. The student will be admitted to a final oral examination upon completion of his dissertation and after he has fulfilled all other requirements set by his committee. This examination will be conducted by his doctoral committee and will be open to all members of the University faculty. The candidate will not be recommended for the doctoral degree if he receives more than one unfavorable vote from his doctoral committee.

COURSES OF INSTRUCTION

Dance

215. **Rhythms and Dance.** II, S. 3 hr. PR: Graduate standing and consent. Principles of movement, materials, and practicum in dance.
219. **Modern Dance Techniques and Composition.** I, S. 3 hr. PR: Phys. Educ. 35 and 36, graduate standing and consent. Application of scientific principles of movement; basic principles of music as related to dance movement; choreographic principles; practicum in dance movement. Principles for teaching the dance and problems involved in planning programs.
296. **American Folk Dance.** I, S. 3 hr. PR: Phys. Educ. 132 or equiv. Study of American Square, contra, circle, and round dances and play party games, and their place in community and school recreation programs. Their origin and relationship to the arts and other aspects of American culture. Analysis of techniques in leading and calling.
319. **History and Philosophy of the Dance.** II, S. 3 hr. PR: Phys. Educ. 219 or equiv. A cultural survey of the dance as an expression of the society it represents; philosophy of the dance; the relation of dance to other art forms; dance as an educational experience and the study of the works of the outstanding artists of today.

Physical Education

206. **Program in Individual Sports.** S. 3 hr. PR: Graduate standing and consent. Designed for coaches of interscholastic athletics. A study of advanced coaching techniques and methods in track and field activities, wrestling, and gymnastics.
207. **Program in Team Sports.** S. 3 hr. PR: Graduate standing and consent. Designed for coaches of interscholastic athletics. A study of advanced techniques, systems of play, offense, defense, methodology, staff organization, and related problems in the coaching of football, basketball and baseball.
208. **Advanced Athletic Training and Conditioning.** I, S. 3 hr. PR: Phys. Educ. 121, 175; Zool. 171, or equiv. To acquaint graduate students with recent theories, practices, and techniques in the prevention, care, and treatment of athletic injuries.
210. **Program in Sports.** S. 3 hr. (W). PR: Phys. Educ. 31, 32, graduate standing and consent. Designed for women engaged in teaching and coaching. Organization and administration of individual, dual, and team sports. Practicum in girls' and women's sports.
211. **Organization and Administration of Intramural Sports.** I, S. 3 hr. PR: 4 hr. of physical education activity courses, graduate standing and consent. Critical analysis with view to justification from standpoint of objectives and of contribution to general welfare of student participation. Organization and administration of programs on secondary and college levels.
212. **Extracurricular Physical Education Activities for Secondary School Girls.** I, S. 3 hr. PR: Graduate standing and consent. Critical analysis of physical education extracurricular activities from the standpoint of objective and contribution to the general welfare of the participants; value of the activities in the school and community; relationship to the physical education program; problems associated with the organization and administration of the program.
213. **Administration of Athletics.** S. 3 hr. PR: Experience in coaching and administration, graduate standing, and consent. The course is designed for persons engaged in actual coaching and administration. A study of the problems associated with the organization and administration of interscholastic and inter-collegiate athletic programs and their relationship to physical education.
275. **Principles and Practices of Adapted Physical Education.** I, S. 3 hr. PR: Zool. 171, Phys. Educ. 175, or equiv. Principles and philosophy in building an adapted program, types of injuries, classification of students, and application of adapted exercises.
276. **Physical Education for the Mentally Retarded.** I, S. 3 hr. PR: Consent. Philosophy, objectives, activities, equipment, program planning, and evaluation of physical education programs for the mentally retarded.
278. **Administration of Physical Education.** II, S. 3 hr. PR: Phys. Educ. 71, 177. Modern theories in physical education and guiding principles in organization and administration of the program.
292. **Physical Education in the Elementary School.** I, S. 3 hr. PR: Teaching experience or consent. Philosophy, objectives, activities, equipment, utilization of space, program planning, and evaluation for a functional program in elementary school physical education.
294. **Philosophy of Physical Education.** I, II, S. 3 hr. PR: Phys. Educ. 117 and 278, graduate standing, and consent. Study of educational philosophies and application of these philosophies to physical education; study of the place of physical education in education and modern living.
295. **Residence in Corrective Therapy.** S. 6 hr. PR: Phys. Educ. 175, 176, and selected psychology courses. An intensive 6-week course offered during the Summer under the auspices of the professional staff of a hospital. The course

consists of 240 clock hours of staff lectures and practical clinical experience in corrective therapy as it is integrated in the Physical Medicine and Rehabilitation Program of a hospital.

- 380. **Curriculum Development in Physical Education.** S. 3 hr. PR: Phys. Educ. 294. Application of principles of growth and development of various age groups to program planning in physical education; evaluation of activities; formulation of criteria as a basis for curriculum revision to meet changing needs in the schools program. (Limited to major students.)
- 394. **Seminar in Physical Education.** I, II, S. 4 hr. PR: Phys. Educ. 294. An overview and critical analysis of the literature and research in physical education.
- 397. **Individual Research Problems in Physical Education.** I, II, S. 1-15 hr. PR: Minimum of 6 sem. hr. in Phys. Educ., including Phys. Educ. 294, and PE-SE 375 or 395; or Educ. 301. Opportunity for independent study and investigation of pertinent problems. For advanced students with practical experience.
- 398. **Practicum in Physical Education.** I, II, S. 4 hr. PR: Phys. Educ. 394, and PE-SE 396 and 397. Program planning, curriculum development, and job functions in physical education.

Safety Education

- 280. **Programs in Safety Education.** I, II, S. 3 hr. PR: Graduate standing and consent. Planning programs, methods and materials for offering instructional programs in safe living in school, home, travel, industry, physical education, athletics, and recreation.
- 281. **Driver and Traffic Safety Education Programs.** II, S. 3 hr. PR: Safety Educ. 280 or equiv., or 20 hr. of Education, graduate standing and consent. Philosophy, objectives, new and advanced equipment, methods and materials in driver and traffic safety education; program planning and evaluative techniques in school and adult programs. Includes laboratory with various methods, materials, and instructional techniques.
- 282. **Problems in Driver and Traffic Safety Education.** I, II, S. 3 hr. PR: Safety Educ. 281 or equiv. or teaching experience in driver education, and graduate standing and consent. An advanced course which gives consideration to individual problems encountered in teaching driver and traffic safety education. Examination of existing courses of study, research and supervisory and evaluative practices.
- 283. **Philosophy of Safety Education.** I, II, S. 3 hr. PR: Safety Educ. 280, 281, or 20 hr. of Education, graduate standing and consent. Study of the place of safety education in modern living; philosophies of safety education as expounded by leaders in the field; emphasis on accident causation and accident prevention in various areas of safety; and research implications.
- 365. **Organization, Administration, and Supervision of School Safety Education.** I, II, S. 3 hr. PR: 20 hr. of Education or Safety Educ. 280 or 283 or equiv., and consent. Designed for teachers, school administrators, college instructors, and others responsible for directing or supervising safety programs in the school. Deals with the problems, policies, practices, and procedures involved in the organization, administration, and supervision of a comprehensive accident prevention and safety education program for the school. Considers integration factors of the school safety programs with the community safety program.
- 394. **Seminar in Safety Education.** I, II, S. 4 hr. PR: Safety Educ. 283. An overview and critical analysis of the literature and research in safety education.
- 397. **Individual Research Problems in Safety Education.** I, II, S. 1-15 hr. PR: Minimum of 6 sem. hr. in Safety Educ., including Safety Educ. 283, PE-SE 375 or 395, or Educ. 301. Opportunity for independent study and investigation of pertinent problems. For advanced students with practical experience.

398. **Practicum in Safety Education.** I, II, S. 4 hr. PR: Safety Educ. 394, and PE-SE 396 and 397. Program planning, curriculum development, and job functions in safety education.

PE-SE

PE-SE courses involve Physical Education and Safety Education.

200. **Workshop.** 1-16 hr.

I. Physical Education

II. Safety Education

301. **The Role of the School Administrator in Conducting Programs in Physical Education and Safety.** S. 2 hr. PR: 20 hr. in Education. A seminar for school administrators on the solution of problems associated with planning, scheduling and conducting school programs in physical education and safety. Consideration is given to program, activity, leadership, facilities, supplies, equipment, finances and supervision. (Not open to major students.)
350. **Measurement in Physical Education and Safety Education.** II, S. 3 hr. PR: Phys. Educ. 294 or Safety Educ. 283. An analysis of evaluative data through statistical procedures and the construction and interpretation of tests.
352. **Statistical Analysis in Physical Education and Safety Education.** II, S. 3 hr. PR: PE-SE 350. The relationship between advanced statistical analyses and experimental designs in research.
355. **Problems in Physical Education and Safety Education.** I, S. 3 hr. PR: Phys. Educ. 294 or Safety Educ. 283. Content and relationship among physical education and safety programs. Aims to develop critical analysis. Follows seminar procedure and presupposes broad academic experience on part of the student.
375. **Introduction to Research.** II, S. 3 hr. PR: Phys. Educ. 294 or Safety Educ. 283. An analysis of the nature and purpose of research with an emphasis upon types and techniques applicable to the areas of health, physical education, recreation, and safety. (Required of all Master of Science degree candidates.)
394. **Supervision.** I, II, S. PR: PE-SE 396 and Educ. 336 or Educ. 335 or Educ. 341. A study and evaluation of supervisory policies, practices, and techniques in physical education and safety education.
395. **Research Seminar.** II, S. 3 hr. PR: Phys. Educ. 394 or Safety Educ. 394 and PE-SE 375 or Educ. 301. Analysis of research design, compilation, organization, treatment and interpretation of data for research projects in physical education and safety. (Required of all candidates for the Doctoral degree.)
396. **Administration Policies.** I, II, S. 3 hr. PR: Phys. Educ. 394 or Safety Educ. 394, and Educ. 339 or Educ. 340. A study and evaluation of administrative policies and practices in physical education, safety education, and athletics.
399. **Thesis.** I, II, S. 6 hr. PR: PE-SE 375 or 395.

Part V / The Graduate Faculty

Ex officio members: The President of the University, the Vice-Presidents, the Provosts, and Deans of the various colleges and schools.

COLLEGE OF AGRICULTURE AND FORESTRY

Faculty of Agricultural Biochemistry

- George A. McLaren, Ph.D. (Okla. St. U.), *Professor of Nutritional Biochemistry. Chairman.*
- James L. Brooks, Ph.D. (U. Calif.), *Assistant Professor of Plant Biochemistry.*
- Morris Ingle, Ph.D. (Purdue U.), *Associate Professor of Agricultural Biochemistry and Horticulture.*
- William G. Martin, Ph.D. (WVU), *Associate Professor of Agricultural Biochemistry.*
- Homer Patrick, Ph.D. (Penn. St. U.), *Professor of Agricultural Biochemistry.*
- Robert L. Reid, Ph.D. (Aberdeen U.), *Associate Professor of Agricultural Biochemistry and Animal Nutrition.*
- David A. Stelzig, Ph.D. (N. Dak. St. U.), *Assistant Professor of Agricultural Biochemistry.*
- Valentin Ulrich, Ph.D. (Rutgers U.), *Professor of Genetics and Agricultural Biochemistry.*
- A. H. VanLandingham, Ph.D. (WVU), *Professor of Agricultural Biochemistry.*
- Alley E. Watada, Ph.D. (U. Calif.), *Assistant Professor of Agricultural Biochemistry and Horticulture.*

Agricultural Economics

- Kenneth D. McIntosh, Ph.D. (U. Wisc.), *Chairman and Associate Professor of Agricultural Economics.*
- Alfred L. Barr, Ph.D., (Okla. St. U.), *Associate Professor of Agricultural Economics.*
- James H. Clarke, M.S. (U. Ky.), *Professor of Agricultural Economics.*
- Homer C. Evans, Ph.D., (U. Minn.), *Professor of Agricultural Economics.*
- Robert L. Jack, Ph.D. (Penn. St. U.), *Associate Professor of Agricultural Economics.*
- Ralph E. Nelson, Ph.D. (U. Minn.), *Assistant Professor of Agricultural Economics.*
- Ernest J. Nesius, Ph.D. (Iowa St. U.), *Professor of Agricultural Economics.*
- Paul E. Nesselroad, M.S. (WVU), *Assistant Professor of Agricultural Economics.*
- James L. Stallings, Ph.D. (Mich. St. U.), *Assistant Professor of Agricultural Economics.*
- George E. Tohen, M.S. (U. Ill.), *Professor of Agricultural Economics.*

Agricultural Education

- Russell C. Butler, Ph.D. (Cornell U.), *Chairman and Professor of Agricultural Education and Professor of Education.*
- Paul V. Armbrester, M.S. (WVU), *Assistant Professor of Agricultural Education and Assistant Director of International Programs.*
- John J. Harvey, Ph.D. (U. Wisc.), *Associate Professor of Agricultural Education, and Director of Agricultural Education, Egerton College, Kenya.*
- Warren C. Kelly, Ed.D. (U. Mo.), *Associate Professor of Agricultural Education and Associate Professor of Education.*

- O. Claude McChes, Ph.D. (Ohio St. U.), *Assistant Professor of Agricultural Education and Assistant Professor of Education.*
- Dixon W. Parsons, Ph.D. (Cornell U.), *Professor Emeritus of Agricultural Education and Professor Emeritus of Education.*
- Robert H. Maxwell, M.S. (Iowa St. U.), *Assistant Professor of Agricultural Education and Chief of Party, Vo-Ag Project, Nairobi, Kenya.*

Agronomy and Genetics

- Collins Veatch, Ph.D. (U. Ill.), *Acting Chairman and Professor of Agronomy.*
- O. J. Burger, Ph.D. (Purdue U.), *Professor of Agronomy.*
- Carl F. Engle, Ph.D. (Penn. St. U.), *Assistant Professor of Agronomy.*
- Everett M. Jencks, Ph.D. (Rutgers U.), *Assistant Professor of Agronomy.*
- Gerald A. Jung, Ph.D. (U. Wisc.), *Professor of Agronomy.*
- Robert F. Keefer, Ph.D. (Ohio St. U.), *Assistant Professor of Agronomy.*
- Joginder Nath, Ph.D. (U. Wisc.), *Associate Professor of Genetics.*
- G. Gordon Pohlman, Ph.D. (Iowa St. U.), *Professor of Agronomy.*
- Richard M. Smith, Ph.D. (Ohio St. U.), *Visiting Professor.*
- Valentin Ulrich, Ph.D. (Rutgers U.), *Professor of Genetics.*

Animal Industry and Veterinary Science

- Marvin R. McClung, Ph.D. (Iowa St. U.), *Chairman and Professor of Animal Industry and Veterinary Science.*
- Richard A. Ackerman, M.S. (WVU), *Assistant Professor of Dairy Science.*
- Gerald C. Anderson, Ph.D. (U. Mo.), *Professor of Animal Science.*
- Leslie Dozsa, D.V.M. (U. Budapest), *Associate Professor of Veterinary Science.*
- Robert S. Dunbar, Jr., Ph.D. (Cornell U.), *Dean of the College of Agriculture and Forestry and Professor of Animal Science.*
- Donald J. Horvath, Ph.D. (Cornell U.), *Professor of Animal Science.*
- Harold M. Hyre, M.S. (Cornell U.), *Associate Professor of Poultry Science.*
- Emmett K. Inskip, Ph.D. (U. Wisc.), *Associate Professor of Animal Science.*
- Robert O. Kelley, Ph.D. (U. Mo.), *Assistant Professor of Animal Science.*
- Harold E. Kidder, Ph.D. (U. Wisc.), *Professor of Animal Science.*
- James L. McBee, Ph.D. (U. Mo.), *Associate Professor of Animal Science.*
- George A. McLaren, Ph.D. (Okla. St. U.), *Professor of Agricultural Biochemistry.*
- William G. Martin, Ph.D. (WVU), *Associate Professor of Agricultural Biochemistry.*
- Norman O. Olson, D.V.M. (Wash. St. U.), *Professor of Veterinary Science.*
- Homer Patrick, Ph.D. (Penn. St. U.), *Professor of Agricultural Biochemistry.*
- Ronald A. Peterson, Ph.D. (Mich. St. U.), *Assistant Professor of Poultry Science.*
- Robert L. Reid, Ph.D. (Aberdeen U.), *Professor of Animal Nutrition.*
- John R. Schabinger, Ph.D. (N.C. St. U.), *Associate Professor of Dairy Science.*
- William V. Thayne, M.S. (U. Ill.), *Instructor in Dairy Science.*
- Roy O. Thomas, Ph.D. (Mich. St. U.), *Assistant Professor of Animal Nutrition.*
- Benjamin W. Wamsley, Jr., M.S. (WVU), *Instructor in Animal Science.*
- Samuel J. Weese, M.A. (WVU), *Associate Professor of Dairy Science.*
- James A. Welch, Ph.D. (U. Ill.), *Professor of Animal Science.*

Forestry

- David E. White, Ph.D. (St. U. N.Y.), *Director and Assistant Professor of Forest Economics.*

Samuel M. Brock, Ph.D. (U. Minn.), *Associate Professor of Forest Economics.*
 Maurice G. Brooks, M.S. (WVU), *Professor of Wildlife Management.*
 James H. Brown, Ph.D. (U. Mich.), *Associate Professor of Silviculture.*
 Kenneth L. Carvell, D.For. (Duke U.), *Professor of Silviculture.*
 Franklin C. Cech, Ph.D. (Tex. A & M), *Professor of Forest Genetics.*
 Allen W. Goodspeed, M.F., (Yale U.), *Professor of Forest Management.*
 Carter S. Hall, M.B.A. (WVU), *State Extension Specialist—Forest Industries, and Assistant Professor.*
 John R. Hamilton, Ph.D. (N.C. St.), *Professor of Wood Science.*
 Joseph M. Hutchison, Jr., M.S. (WVU), *Assistant Professor of Recreation.*
 Norman D. Jackson, M.W.T. (N.C. St.), *Assistant to the Director and Assistant Professor of Wood Science.*
 William E. Kidd, Jr., M.S. (V.P.I.), *Assistant Professor of Forestry; State Extension Specialist—Forest Management.*
 Christian B. Koch, Ph.D. (U. Mich.), *Professor of Wood Science.*
 Don L. Kulow, Ph.D. (Mich. St. U.), *Assistant Professor of Forest Mensuration.*
 Peter R. Mount, Ph.D. (Colo. St. U.), *Assistant Professor of Forest Economics.*
 Richard Lee, Ph.D. (Colo. St. U.), *Associate Professor of Forest Hydrology.*
 John G. Scherlacher, M.Ed. (U. Pittsburgh), *Professor of Recreation.*
 Robert L. Smith, Ph.D. (Cornell U.), *Associate Professor of Wildlife Management.*
 Hans-Peter Steinhagen, Dipl.-Holzwirt (Hamburg U., Germany), *Visiting Assistant Professor of Wood Science.*
 Earl H. Tryon, Ph.D. (Yale U.), *Professor of Silviculture.*

Horticulture

Eion G. Scott, Ph.D. (U. Calif.), *Chairman and Professor of Horticulture.*
 Bradford C. Bearce, Ph.D. (U. Calif.), *Assistant Professor of Horticulture.*
 James L. Brooks, Ph.D. (U. Calif.), *Assistant Professor of Plant Biochemistry.*
 Linda Butler, Ph.D. (U. Ga.), *Assistant Professor of Entomology.*
 William H. Childs, Ph.D. (Cornell U.), *Professor of Horticulture.*
 Carl K. Dorsey, Ph.D. (WVU), *Professor of Entomology.*
 Arthur P. Dye, M.S. (WVU), *Associate Professor of Horticulture (retired).*
 Donald W. Girouard, M.L.A. (Harvard Graduate School of Design), *Assistant Professor of Landscape Architecture.*
 Morris Ingle, Ph.D. (Purdue U.), *Associate Professor of Horticulture.*
 Joseph J. Lalli, M.L.A. (U. Mich.), *Assistant Professor of Landscape Architecture.*
 George W. Longenecker, M.F.A. (U. Ill.), *Assistant Professor of Landscape Architecture.*
 Ray S. Marsh, A.M. (U. Mo.), *Professor Emeritus of Horticulture.*
 Oliver M. Neal, Jr., Ph.D. (Mich. St. U.), *Professor of Horticulture.*
 Oscar E. Schubert, Ph.D. (U. Ill.), *Professor of Horticulture.*
 David A. Stelzig, Ph.D. (N. Dak. St. U.), *Assistant Professor of Agricultural Biochemistry.*
 Alley E. Watada, Ph.D. (U. Calif.), *Associate Professor of Horticulture.*

Plant Pathology and Bacteriology

Horace L. Barnett, Ph.D. (Mich. St. U.), *Chairman of Plant Pathology and Bacteriology, and Professor of Mycology.*
 Robert E. Adams, Ph.D. (Cornell U.), *Associate Professor of Plant Pathology.*
 Lowell L. Black, Ph.D. (U. Wisc.), *Assistant Professor of Plant Pathology.*

Edward S. Elliott, Ph.D. (WVU), *Professor of Plant Pathology.*
Mannon E. Gallegly, Jr., Ph.D. (U. Wisc.), *Professor of Plant Pathology.*
John A. Koburger, Ph.D. (N.C. St.), *Associate Professor of Agricultural Bacteriology.*
Virgil G. Lilly, Ph.D. (WVU), *Professor of Physiology.*
Rodney P. True, Ph.D. (U. Penn.), *Professor of Plant Pathology.*
Harold A. Wilson, Ph.D. (Iowa St. U.), *Professor of Agricultural Bacteriology.*

COLLEGE OF ARTS AND SCIENCES

Department of Biology

Jay Barton II, Ph.D. (U. Mo.), *Chairman and Professor of Biology.*
Lila Abrahamson, Ph.D. (U. Mich.), *Associate Professor of Biology.*
Charles H. Baer, Ph.D. (U. Md.), *Associate Professor of Biology.*
Elizabeth Ann Bartholomew, M.S. (WVU), *Assistant Curator of Herbarium;
Instructor in Biology.*
Herald D. Bennett, Ph.D. (St. U. Iowa), *Professor of Biology.*
Arnold Benson, M.A. (U. Colo.), *Assistant Professor of Biology.*
Robert L. Birch, M.S. (Penn. St. U.), *Assistant Professor of Biology.*
David F. Blaydes, Ph.D. (U. Ind.), *Assistant Professor of Biology.*
W. Newman Bradshaw, Ph.D. (U. Tex.), *Associate Professor of Biology.*
Hwa-Ruey Chen, Ph.D. (Yale U.), *Assistant Professor of Biology.*
Roy B. Clarkson, Ph.D. (WVU), *Professor of Biology.*
Jesse F. Clovis, Ph.D. (Cornell U.), *Associate Professor of Biology.*
William E. Collins, Ph.D. (U. Wisc.), *Assistant Professor of Biology.*
Mullen O. Coover, M.S. (WVU), *Assistant Professor of Biology.*
Earl L. Core, Ph.D. (Columbia U.), *Curator of Herbarium, Professor Emeritus of
Biology.*
John J. Eichenmuller, Ph.D. (WVU), *Assistant Professor of Biology.*
Ramsey H. Frist, Ph.D. (U. Pittsburgh), *Assistant Professor of Biology.*
Lloyd R. Gribble, Ph.D. (WVU), *Associate Dean, Arts and Sciences; Professor of
Biology.*
Roland L. Guthrie, Ph.D. (WVU), *Assistant Professor of Biology; Director of
Arboretum.*
Willis H. Hertig, Jr., Ph.D. (WVU), *Assistant Professor of Biology.*
Henry W. Hurlbutt, Ph.D. (U. Md.), *Assistant Professor of Biology. (On leave).*
Edward C. Keller, Jr., Ph.D. (Penn. St. U.), *Professor of Biology.*
Joseph A. Marshall, Ph.D. (U. Md.), *Assistant Professor of Biology.*
Ethel C. Montiegel, M.S. (WVU), *Assistant Professor of Biology.*
Charles Norman, Ph.D. (U. Iowa), *Professor of Biology.*
Martin W. Schein, Sc.D. (Johns Hopkins U.), *Centennial Professor of Biology.*
Richard P. Sutter, Ph.D. (Tufts U.), *Assistant Professor of Biology.*

Chemistry

Vincent J. Traynelis, Ph.D. (Wayne St. U.), *Chairman and Professor of Chemistry.*
Roger V. Chastain, Jr., Ph.D. (U. Wash.), *Assistant Professor of Chemistry.*
Armand R. Collett, Ph.D. (Yale U.), *Professor Emeritus of Chemistry.*
John A. Gibson, Jr., Ph.D. (M.I.T.), *Professor Emeritus of Chemistry.*
Keith Gosling, Ph.D. (Manchester Coll.), *Assistant Professor of Chemistry.*
John Gruninger, Ph.D. (U. Penn.), *Assistant Professor of Chemistry.*

George A. Hall, Jr., Ph.D. (Ohio St. U.), *Associate Professor of Chemistry*.
 James L. Hall, Ph.D. (U. Wisc.), *Professor of Chemistry*.
 James B. Hickman, Ph.D. (Penn. St. U.), *Professor of Chemistry*.
 George L. Humphrey, Ph.D. (Ore. St. U.), *Associate Chairman and Professor of Chemistry*.
 Charles L. Lazzell, Ph.D. (Yale U.), *Professor Emeritus of Chemistry*.
 Alan C. Ling, Ph.D. (U. London), *Assistant Professor of Chemistry*.
 William J. McCarthy, Ph.D. (U. Fla.), *Assistant Professor of Chemistry*.
 Charles G. McCarty, Ph.D. (U. Ill.), *Assistant Professor of Chemistry*.
 Bailie J. McCormick, Ph.D. (Okla. St. U.), *Associate Professor of Chemistry*.
 Denis W. H. MacDowell, Ph.D. (M.I.T.), *Associate Professor of Chemistry*.
 Chester W. Muth, Ph.D. (Ohio St. U.), *Professor of Chemistry*.
 Armine D. Paul, Ph.D. (U. Calif.), *Associate Professor of Chemistry*.
 Carl R. Phillips, Ph.D. (Ind. U.), *Assistant Professor of Chemistry*.
 Peter Popovich, Ph.D. (Wash. St. U.), *Associate Professor of Chemistry*.
 John H. Strohl, Ph.D. (U. Wisc.), *Assistant Professor of Chemistry*.
 Anthony Winston, Ph.D. (Duke U.), *Associate Professor of Chemistry*.

English

Ruel E. Foster, Ph.D. (Vanderbilt U.), *Chairman and Professor of English*.
 James P. Brawner, Ph.D. (U. Ill.), *Professor of English*.
 Mary Catherine Buswell, M.A. (WVU), *Associate Professor of English*.
 Robert W. Clarke, Ph.D. (U. Wisc.), *Associate Professor of English*.
 Lloyd M. Davis, M.A. (Vanderbilt U.), *Assistant Professor of English*.
 John W. Draper, Ph.D. (N.Y.U.), *Professor Emeritus of English*.
 Richard B. Eaton, Ph.D. (U. N.C.), *Assistant Professor of English*.
 William W. French, Ph.D. (U. Pittsburgh), *Assistant Chairman and Assistant Professor of English*.
 Patrick W. Gainer, Ph.D. (St. Louis U.), *Professor of English*.
 Avery F. Gaskins, M.A. (Ind. U.), *Assistant Professor of English*.
 W. Michael Grant, Ph.D. (Brown U.), *Assistant Professor of English*.
 John L. Hicks, Jr., M.A. (Ind. U.), *Associate Professor of English and Chairman of Freshman English*.
 Martha C. Howard, M.A. (U. Mich.), *Assistant Professor of English*.
 John H. Johnston, Ph.D. (U. Wisc.), *Professor of English*.
 Russell C. MacDonald, Ph.D. (U. Penn.), *Associate Professor of English*.
 Virgil A. Peterson, Ph.D. (U.C.L.A.), *Associate Professor of English*.
 John Racin, Jr., Ph.D. (Ohio St. U.), *Associate Professor of English*.
 John F. Stasny, M.A. (Marquette U.), *Assistant Professor of English*.
 Judith G. Stitzel, Ph.D. (U. Minn.), *Assistant Professor of English*.
 Jack Welch, M.F.A. (U. Iowa), *Assistant Professor of English*.

Foreign Languages

Robert Stilwell, Ph.D. (U. Tex.), *Chairman of Foreign Languages and Professor of German*.
 Michel J. Beauchemin, M.A. (Brown U.), *Assistant Professor of Romance Languages*.
 Laszlo Borsay, Ph.D. (U. Pittsburgh), *Associate Professor of Classical Languages*.
 M. William Buechle, M.A. (U. Colo.), *Instructor in German*.
 Rafael R. Del Valle, Ph.D. (Natl. U. Mexico), *Associate Professor of Latin American Area Studies*.

Emile G. Frere, Ph.D. (U. Pittsburgh), *Associate Professor of French*.
 Eleanor R. Gibbard, M.A. (WVU), *Instructor in French and Foreign Language Examiner*.
 Pablo Gonzalez, M.A. (U. Pittsburgh), *Assistant Professor of Spanish*.
 Francisco Herrera, M.A. (WVU), *Associate Professor of Spanish; Director of Latin American Area Program*.
 Donald T. Huffman, M.A. (Ind. U.), *Assistant Professor of German*.
 Victor J. Lemke, Ph.D. (U. Wisc.), *Professor of German*.
 Arthur C. McBride, Docteur De L'Universite Bordeaux (U. Bordeaux), *Professor Emeritus of French*.
 Warren F. Manning, Ph.D. (Harvard U.), *Professor Emeritus of Romance Languages*.
 Carlos Navarro, Ph.D. (U. Pittsburgh), *Assistant Professor of Spanish*.
 Bohdan Plaskacz, Ph.D. (U. Ottawa), *Professor of Slavic Languages*.
 Jean-Pierre M. Ponchie, M.A. (U. Mich.), *Assistant Professor of French*.
 Joseph J. Prentiss, M.A. (U. Pittsburgh), *Instructor in Classical Languages*.
 Joseph F. Renahan, M.S. (Yeshiva U.), *Instructor in Romance Languages*.
 Armand E. Singer, Ph.D. (Duke U.), *Professor of Romance Languages and Chairman of Humanities*.
 Claude C. Spiker, Ph.D. (U. Chicago), *Professor Emeritus of Romance Languages*.
 Harley U. Taylor, Jr., Ph.D. (Ind. U.), *Associate Professor of German*.
 Rebecca E. Wade, M.A. (Middlebury C.), *Assistant Professor of French*.

Geology and Geography

Dana Wells, Ph.D. (Columbia U.), *Chairman and Professor of Geology*.
 Arthur E. Burford, Ph.D. (U. Mich.), *Associate Professor of Geology*.
 Robert G. Corbett, Ph.D. (U. Mich.), *Associate Professor of Geology*.
 Chester L. Dodson, M.S. (WVU), *Assistant Professor of Geology*.
 Alan C. Donaldson, Ph.D. (Penn. St. U.), *Professor of Geology*.
 Harry M. Fridley, Ph.D. (Cornell U.), *Professor Emeritus of Geology*.
 Milton T. Heald, Ph.D. (Harvard U.), *Professor of Geology*.
 Richard S. Little, Ph.D. (Syracuse U.), *Associate Professor of Geography*.
 John C. Ludlum, Ph.D. (Cornell U.), *Professor of Geology*.
 Richard R. Pillsbury, M.A. (LSU), *Assistant Professor of Geography*.
 John J. Renton, Ph.D. (WVU), *Assistant Professor of Geology*.
 Chester E. Zimolzak, M.A. (U. Wisc.), *Assistant Professor of Geography*.

History

William T. Doherty, Jr., Ph.D. (U. Mo.), *Chairman and Professor of History*.
 Wesley M. Bagby, Ph.D. (Columbia U.), *Professor of History*.
 William D. Barns, Ph.D. (WVU), *Associate Professor of History*.
 John A. Caruso, Ph.D. (WVU), *Professor of History*.
 Oliver P. Chitwood, Ph.D. (Johns Hopkins U.), *Professor Emeritus of History*.
 Elizabeth Cometti, Ph.D. (U. Va.), *Professor of History*.
 Charles W. Connell, Ph.D. (Rutgers U.), *Assistant Professor of History*.
 Jason C. Easton, Ph.D. (U. Wisc.), *Professor Emeritus of History*.
 Jack Hammersmith, M.A. (U. Calif.), *Assistant Professor of History*.
 James W. Hess, Ph.D. (Harvard U.), *Assistant Professor of History*.
 James N. Hood, M.A. (Princeton U.), *Assistant Professor of History*.
 Elizabeth K. Hudson, Ph.D. (Ind. U.), *Assistant Professor of History*.

Mortimer Levine, Ph.D. (U. Penn.), *Professor of History*.
 John A. Maxwell, M.A. (WVU), *Lecturer in History*.
 Kurt Rosenbaum, Ph.D. (Syracuse U.), *Associate Professor of History*.
 Sara R. Smith, Ph.D. (Columbia U.), *Associate Professor Emeritus of History*.
 Edward M. Steel, Jr., Ph.D. (U. N.C.), *Associate Professor of History*.
 Festus P. Summers, Ph.D. (WVU), *Professor Emeritus of History; University Historian*.

Library Science

Robert F. Munn, Ph.D. (U. Mich.), *Director of Libraries; Chairman and Professor of Library Science*.
 Stokely B. Gribble, M.S.L.S. (U. Ky.), *Assistant Director of Libraries; Assistant Professor of Library Science*.
 Clifford Hamrick, M.L.S. (Rutgers U.), *Senior Reference Librarian; Assistant Professor of Library Science*.
 Evelyn Kocher, M.S.L.S. (U. N.C.), *Chief Catalog Librarian; Assistant Professor of Library Science*.
 Olive D. Lewis, M.L.S. (U. Pittsburgh), *Assistant Professor of Library Science*.
 Victorine A. Louistall, M.S.L.S. (WVU), *Assistant Professor of Library Science*.
 Lorise C. Topliffe, M.S.L.S. (L.S.U.), *Senior Reference Librarian; Assistant Professor of Library Science*.

Mathematics

James C. Eaves, Ph.D. (U. N.C.), *Chairman and Centennial Professor of Mathematics*.
 I. Dee Peters, M.S. (WVU), *Associate Chairman and Associate Professor of Mathematics*.
 Donald F. Butcher, Ph.D. (Iowa St. U.), *Assistant Professor of Statistics*.
 Anand M. Chak, Ph.D. (Lucknow U., India), *Assistant Professor of Mathematics*.
 Charles N. Cochran, M.S. (WVU), *Associate Professor of Mathematics*.
 Allen B. Cunningham, Ph.D. (WVU), *Professor of Mathematics*.
 Hannibal A. Davis, Ph.D. (Cornell U.), *Professor Emeritus of Mathematics*.
 Joy Bromberg Easton, M.S. (WVU), *Assistant Professor of Mathematics*.
 Henry W. Could, M.A. (U. Va.), *Professor of Mathematics*.
 Franz X. Hiergeist, Ph.D. (U. Pittsburgh), *Assistant Professor of Mathematics*.
 Mahendra K. Jain, Ph.D. (Lucknow U., India), *Assistant Professor of Mathematics*.
 A. John, Ph.D. (London U., England), *Visiting Assistant Professor of Statistics*.
 Alonzo Johnson, Ed.D. (Okla. St. U.), *Assistant Professor of Mathematics*.
 Jin Bai Kim, Ph.D. (V.P.I.), *Assistant Professor of Mathematics*.
 George E. Mitchell, Ph.D. (U. Va.), *Assistant Professor of Mathematics*.
 John W. Randolph, Ph.D. (U. Va.), *Assistant Professor of Mathematics*.
 A. L. Roark, Ph.D. (U. N. M.), *Associate Professor of Mathematics*.
 H. M. Srivastava, Ph.D. (Jodhpur U., India), *Assistant Professor of Mathematics*.
 Joseph K. Stewart, Ph.D. (WVU), *Professor of Mathematics*.
 Edwin C. Townsend, Ph.D. (Cornell U.), *Associate Professor of Statistics*.
 V. A. Uthoff, Ph.D. (U. Iowa), *Assistant Professor of Statistics*.
 Charles H. Vehse, Ph.D. (Brown U.), *Professor Emeritus of Mathematics*.
 Marvin L. Vest, Ph.D. (U. Mich.), *Professor of Mathematics*.
 Ronson J. Warne, Ph.D. (U. Tenn.), *Professor of Mathematics*.
 Stanley Wearden, Ph.D. (Cornell U.), *Professor of Statistics*.

Philosophy

- William S. Haymond, M.A. (Harvard U.), Ph.D. (St. Louis U.), *Chairman and Professor of Philosophy*.
John R. Cresswell, Ph.D. (Cornell U.), *Professor of Philosophy*.
Theodore M. Drange, Ph.D. (Cornell U.), *Associate Professor of Philosophy*.
Thomas W. Scharle, M.A. (Notre Dame U.), *Assistant Professor of Philosophy*.

Physics

- Arthur S. Pavlovic, Ph.D. (Penn. St. U.), *Chairman and Professor of Physics*.
F. Burr Anderson, Ph.D. (U. Penn.), *Assistant Professor of Physics*.
Atam P. Arya, Ph.D. (Penn. St. U.), *Associate Professor of Physics*.
Stanley Farr, M.S. (WVU), *Assistant Professor of Physics*.
Oleg Jefimenko, Ph.D. (U. Ore.), *Professor of Physics*.
Arnold S. Levine, Ph.D. (Columbia U.), *Associate Professor of Physics*.
Edward F. Pulver, Ph.D. (Penn. St. U.), *Assistant Professor of Physics*.
John L. Rodda II, Ph.D. (Iowa St.), *Assistant Professor of Physics*.
Carl A. Rotter, Ph.D. (Case Tech), *Assistant Professor of Physics*.
Charles D. Thomas, Ph.D. (U. Chicago), *Professor of Physics*.
Richard P. Treat, Ph.D. (U.C.L.A.), *Assistant Professor of Physics*.
William E. Vehse, Ph.D. (Carnegie Tech), *Associate Professor of Physics*.
Douglas B. Williamson, Ed.D. (Columbia U.), *Associate Professor of Physics*.

Political Science

- John R. Williams, Ph.D. (Duke U.), *Chairman and Professor of Political Science*.
Orrin B. Conaway, Jr., Ph.D. (Syracuse U.), *Benedum Professor of American Government and Administration*.
Thomas M. Drake, M.A. (Duke U.), *Assistant Professor of Political Science*.
Carl M. Frasure, Ph.D. (Ohio St. U.), *Professor of Political Science; Dean, College of Arts and Sciences*.
Royal C. Gilkey, Ph.D. (U. Minn.), *Professor of Political Science*.
Allan S. Hammock, M.A. (Georgetown U.), *Assistant Professor of Political Science*.
John A. Jacobsohn, Ph.D. (U. Md.), *Assistant Professor of Political Science*.
Hong Nack Kim, Ph.D. (Georgetown U.), *Assistant Professor of Political Science*.
Alan S. Komins, M.A. (U. Pittsburgh), *Area Program Chairman*.
Robert Eugene Lanham, M.A. (Calif. St. Coll., L.A.), *Instructor in Political Science*.
Sophia Peterson, M.A. (U.C.L.A.), *Assistant Professor of Political Science*.
George W. Rice, Ph.D. (Ohio St. U.), *Associate Professor of Political Science*.
William R. Ross, M.A. (WVU), *Associate Professor of Political Science*.
Irvin Stewart, Ph.D. (Columbia U.), *Professor Emeritus of Political Science*.
David G. Temple, Ph.D. (U. Va.), *Associate Professor of Political Science*.
James B. Whisker, M.A. (Niagara U.), *Assistant Professor of Political Science*.
Herbert G. Wilcox, Ph.D. (N. Y. U.), *Associate Professor of Political Science, Kanawha Valley Graduate Center*.
Rodger D. Yeager, Ph.D. (Syracuse U.), *Assistant Professor of Political Science*.

Psychology

- K. Warner Schaie, Ph.D. (U. Wash.), *Chairman and Professor of Psychology*.
Paul B. Baltes, Dr.Phil. (U. Saarland), *Assistant Professor of Psychology*.

James F. Carruth, Ph.D. (U. Ill.), *Professor of Psychology*.
 Philip E. Comer, Ph.D. (WVU), *Assistant Professor of Psychology*.
 Charles D. Corman, Ph.D. (Ohio St. U.), *Assistant Professor of Psychology*.
 Orrin H. Cross, Ph.D. (U. Pittsburgh), *Associate Professor of Psychology*.
 Quin F. Curtis, Ph.D. (U. Mich.), *Professor of Psychology*.
 Robert L. Decker, Ph.D. (Carnegie Tech), *Associate Professor of Psychology*.
 Irving J. Goodman, Ph.D. (U. Rochester), *Assistant Professor of Psychology*.
 Larry R. Goulet, Ph.D. (St. Louis U.), *Associate Professor of Psychology*.
 Thomas E. Hammock, Ph.D. (Duke U.), *Assistant Professor of Psychology*.
 Frank H. Hooper, Ph.D. (Wayne St. U.), *Assistant Professor of Psychology and Child Development*.
 Alfred Jacobs, Ph.D. (Iowa St. U.), *Professor of Psychology*.
 Roger F. Maley, Ph.D. (U. Neb.), *Assistant Professor of Psychology*.
 John R. Nesselroade, Ph.D. (U. Ill.), *Assistant Professor of Psychology*.
 L. Lynn Ourth, Ph.D. (U. Mo.), *Associate Professor of Psychology*.
 Eugene A. Quarrick, Ph.D. (Syracuse U.), *Associate Professor of Psychology*.
 Lewis B. Sachs, Ph.D. (Wash. St. U.), *Assistant Professor of Psychology*.
 James N. Shafer, Ph.D. (Ohio St. U.), *Professor of Psychology*.

Religious Studies

Manfred O. Meitzen, Ph.D. (Harvard U.), *Associate Professor of Religious Studies*.
 Paul M. Bassett, Ph.D. (Duke U.), *Assistant Professor of Religious Studies*.

Sociology

Harold A. Gibbard, Ph.D. (U. Mich.), *Chairman and Professor of Sociology*.
 Ronald C. Althouse, Ph.D. (U. Minn.), *Assistant Professor of Sociology*.
 Richard A. Ball, Ph.D. (Ohio St. U.), *Associate Professor of Sociology*.
 Billy L. Coffindaffer, Ph.D. (U. Wisc.), *Associate Professor of Sociology*. (*On leave*).
 Harold N. Kerr, Ph.D. (Ohio St. U.), *Associate Professor of Sociology*.
 Ann L. Paterson, Ph.D. (Mich. St. U.), *Instructor in Sociology*.
 John D. Photiadis, Ph.D. (Cornell U.), *Professor of Sociology*.
 Harry K. Schwarzweller, Ph.D. (Cornell U.), *Professor of Sociology*.
 Leonard M. Sizer, Ph.D. (St. U. Iowa), *Associate Professor of Sociology*.
 I. Thomas Stone, Ph.D. (Cornell U.), *Assistant Professor of Sociology (Anthropology)*.
 Joel M. Teitelbaum, M.A. (U. Manchester), *Assistant Professor of Sociology (Anthropology)*.
 Ernest A. Vargas, M.A. (Columbia U.), *Assistant Professor of Sociology*.
 Neil J. Weller, Ph.D. (U. Mich.), *Assistant Professor of Sociology*.

Speech

Leonard M. Davis, Ph.D. (Northwestern U.), *Chairman and Professor of Speech*.
 William L. Barnett, M.A. (U. Ala.), *Assistant Professor of Speech*.
 Betty S. Hall, M.A. (WVU), *Instructor in Speech*.
 Leroy E. Kennel, Ph.D. (Mich. St. U.), *Associate Professor of Speech*.
 Don J. Norwood, M.A. (L.S.U., WVU), *Assistant Professor of Speech*.
 Walter H. Rockenstein, Ph.D. (Northwestern U.), *Associate Professor of Speech*.
 Lloyd W. Welden, Sr., M.A. (U. Mo.), *Professor of Speech*.

INSTITUTE OF BIOLOGICAL SCIENCES

Faculty of Genetics—Developmental Biology

- David F. Blaydes, Ph.D. (Ind. U.), Assistant Professor of Biology. *Developmental Biology.*
- Donald F. Butcher, Ph.D. (Iowa St. U.), Associate Professor of Statistics. *Statistics and Mammalian Genetics.*
- Roy L. Butcher, Ph.D. (Iowa St. U.), Assistant Professor of Obstetrics and Gynecology. *Human Genetics and Reproductive Physiology.*
- Franklin C. Cech, Ph.D. (Tex. A & M), Professor of Forest Genetics. *Genetics and Improvement of Forest Trees.*
- Hwa-Ruey Chen, Ph.D. (Yale U.), Assistant Professor of Biology. *Developmental Biology and Physiology.*
- Vincent F. Gerencser, Ph.D. (U. Ky.), Associate Professor of Microbiology. *Bacterial and Viral Genetics.*
- Enid F. Gilbert, M.B.B.S. (U. Sydney, Australia), Associate Professor of Pathology. *Developmental Biology.*
- James B. Gilbert, M.D. (Jefferson Med. C.), Assistant Professor of Biochemistry. *Regulation of Protein Synthesis.*
- Barbara Jones, M.D. (U. Utah), Associate Professor of Pediatrics. *Hematology, Oncology and Bilirubin Metabolism.*
- Richard C. Juberg, M.D., Ph.D. (U. Mich.), Assistant Professor of Pediatrics. *Marker Chromosomes and Linkage in Man. Human Chromosome Aberrations. Blood Group and Disease Associations.*
- Ed Keller, Ph.D., Professor of Biology. *Quantitative and Biochemical Genetics.*
- Robert E. McCafferty, Ph.D. (U. Pittsburgh), Associate Professor of Anatomy. *Research Associate in Obstetrics and Gynecology. Developmental Biology.*
- Henry F. Mengoli, Ph.D. (Catholic U. America), Research Associate in Pathology. *Developmental Biology and Immunology.*
- Ethel C. Montiegel, M.S. (WVU), Assistant Professor of Biology. *Developmental Biology.*
- Joginder Nath, Ph.D. (U. Wisc.), Associate Professor of Genetics. *Cytogenetics, Cytology and Cryobiology.*
- Oliver M. Neal, Jr., Ph.D. (Mich. St. N.), Professor of Horticulture. *Plant Genetics and Tissue Culture.*
- Randall W. Reyner, Ph.D. (Yale U.), Professor of Anatomy. *Developmental Biology.*
- William V. Thayne, M.S. (U. Ill.), Instructor in Animal Industry. *Quantitative Genetics.*
- Valentin Ulrich, Ph.D. (Rutgers U.), Associate Professor of Genetics. *Molecular and Biochemical Genetics.*
- Knox Van Dyke, Ph.D. (St. Louis U.), Research Associate in Pharmacology. *Biochemical Genetics and Physiology.*
- Herbert G. Voelz, Dipl. Biol., Dr. rer. ant. (U. Greifswald, Germany), Associate Professor of Microbiology. *Cytology and Electron Microscopy.*
- Stanley Wearden, Ph.D. (Cornell U.), Professor of Statistics. *Statistics and Population Genetics.*

Faculty of Plant Physiology

- Lila Abrahamson, Ph.D. (U. Mich.), Associate Professor of Biology. *Plant Physiology.*
- Charles H. Baer, Ph.D. (U. Md.), Associate Professor of Biology. *Plant soil water relations, environmental physiology, micro-meteorology.*
- Bradford C. Bearce, Ph.D. (U. Calif.), Assistant Professor of Horticulture. *Plant Physiology.*

- David F. Blaydes, Ph.D. (Ind. U.), *Assistant Professor of Biology. Tissue culture, biochemistry, plant growth regulators.*
- Hwa-Ruey Chen, Ph.D. (Yale U.), *Assistant Professor of Biology. Experimental and biochemical studies of plant growth and development.*
- Morris Ingle, Ph.D. (Purdue U.), *Associate Professor of Horticulture. Post-harvest physiology of tree-fruits. Physiology and biochemistry of maturation and senescence in fruits.*
- Gerald A. Jung, Ph.D. (U. Wisc.), *Associate Professor of Agronomy. Physiology and biochemistry of cold hardiness.*
- Eion G. Scott, Ph.D. (U. Calif.), *Professor of Horticulture. Micro-elements and growth.*
- Alley E. Watada, Ph.D. (U. Calif.), *Assistant Professor of Horticulture. Physiology of vegetable crops. Physiology and biochemistry of maturation and senescence.*

Faculty of Reproductive Physiology

- Walter A. Bonney, Jr., M.D. (Columbia U.), *Professor and Chairman of Obstetrics and Gynecology.*
- Roy L. Butcher, Ph.D. (Iowa St. U.), *Assistant Professor of Obstetrics and Gynecology. Human Genetics and Reproductive Physiology.*
- Richard J. Cenedella, Ph.D. (Jefferson Med. C.), *Assistant Professor of Pharmacology.*
- William E. Collins, Ph.D. (U. Wisc.), *Assistant Professor of Biology. Reproductive Physiology.*
- Nicholas W. Fugo, Ph.D. (St. U. Iowa), M.D. (U. Chicago), *Research Professor of Obstetrics and Gynecology.*
- Donald J. Horvath, Ph.D. (Cornell U.), *Professor of Animal Science. Reproductive Physiology.*
- Harold M. Hyre, M.S. (Cornell U.), *Associate Professor of Animal Science.*
- E. Keith Inskeep, Ph.D. (U. Wisc.), *Associate Professor of Animal Industry and Veterinary Science.*
- John E. Jones, M.D. (U. Utah), *Associate Professor of Internal Medicine. Chairman of the Division of Metabolism Endocrinology.*
- Harold E. Kidder, Ph.D. (U. Wisc.), *Professor of Animal Science and Animal Husbandry.*
- Robert E. McCafferty, Ph.D. (U. Pittsburgh), *Associate Professor of Anatomy. Research Associate in Obstetrics and Gynecology.*
- Walter H. Moran, Jr., M.D. (Harvard U.), *Associate Professor of Surgery and Biophysics.*
- Joginder Nath, Ph.D. (U. Wisc.), *Associate Professor of Genetics. Reproductive Physiology.*
- Charles Norman, Ph.D. (St. U. Iowa), *Professor of Biology. Reproductive Physiology.*
- Ronald A. Peterson, Ph.D. (Mich. St. U.), *Assistant Professor of Animal Science.*
- John A. Thomas, Ph.D. (St. U. Iowa), *Associate Professor of Pharmacology. Reproductive Physiology.*

COLLEGE OF COMMERCE

- Jack T. Turner, D.B.A. (Ind. U.), *Dean and Professor of Marketing.*
- Vance Q. Alvis, Ph.D. (U. Va.), *Professor of Economics.*
- Lewis C. Bell, Ph.D. (U. Ky.), *Fiscal Consultant and Professor of Economics.*
- Robert D. Britt, Ph.D. (U. Colo.), *Assistant Professor of Economics.*
- Thomas C. Campbell, Jr., Ph.D. (U. Pittsburgh), *Professor of Economics. (On leave).*
- Lynn E. Dellenbarger, Jr., Ph.D. (U. Fla.), *Professor of Finance.*

Edward K. Dix, Ph.D. (U. Md.), *Assistant Professor of Commerce.*
 Betty G. Fishman, M.A. (N.Y.U.), *Assistant Professor of Economics.*
 Leo Fishman, Ph.D. (N.Y.U.), *Professor of Economics and Finance.*
 Raymond M. Haas, D.B.A. (Ind. U.), *Associate Professor of Marketing.*
 Paul W. Hamelman, Ph.D. (U. Pittsburgh), *Associate Professor of Management.*
 John L. Harpell, Jr., M.B.A. (Ga. St. C.), *Assistant Professor of Management.*
 Thomas S. Issack, D.B.A. (Ind. U.), *Professor of Management.*
 Edward A. Johnson, Ph.D. (Mich. St.), *Assistant Professor of Management.*
 Jay E. Johnson, M.B.A. (N.Y.U.), C.P.A. (W. Va.), *Assistant Professor of Accounting.*
 Woo Sik Kee, Ph.D. (Syracuse U.), *Associate Professor of Economics.*
 George E. Kirk, M.B.A. (Ind. U.), *Assistant Professor of Management.*
 Raymond R. McKay, M.S. (So. Ill. U.), *Assistant Professor of Economics.*
 Patrick C. Mann, Ph.D. (Ind. U.), *Assistant Professor of Economics.*
 Robert S. Maust, M.S. (WVU), C.P.A. (W. Va.), *Assistant Professor of Accounting.*
 Edward M. Mazze, Ph.D. (Penn. St. U.), *Associate Professor of Marketing.*
 William H. Miernyk, Ph.D. (Harvard U.), *Professor of Economics.*
 John L. Mikesell, M.A. (U. Ill.), *Assistant Professor of Economics.*
 Joseph Newhouse, M.S. (WVU), *Associate Professor of Economics and Finance.*
 Donald E. Pursell, Ph.D. (Duke U.), *Assistant Professor of Economics.*
 Richard R. Raymond, Ph.D. (Brown U.), *Associate Professor of Economics.*
 Evan O. Roberts, Ph.D. (U. Wisc.), *Professor of Economics and Marketing.*
 Gilbert Rutman, Ph.D. (Duke U.), *Assistant Professor of Economics.*
 Robert J. Saunders, Ph.D. (U. Ky.), *Associate Professor of Economics.*
 Charles P. Skaggs, M.S. (WVU), C.P.A. (W. Va.), *Assistant Professor of Accounting.*
 Anthony H. Stocks, Ph.D. (St. U. N.Y.), *Associate Professor of Economics.*
 James H. Thompson, Ph.D. (U. Pittsburgh), *Professor of Economics.*
 Boone Tillet, Ph.D. (St. Lawrence U.), *Visiting Professor of Management.*
 Vern H. Vincent, Ph.D. (U. Mich.), C.P.A. (Tex., Tenn., W. Va.), *Professor of Accounting.*
 Fred E. Wright, II, M.A. (WVU), *Associate Professor of Finance.*
 Fred Zeller, Ph.D. (Ohio St. U.), *Associate Professor of Economics.*

CREATIVE ARTS CENTER

Division of Music

Richard E. Duncan, Ph.D. (Eastman Sch. Music, U. Rochester), *Dean and Director of Creative Arts Center and Professor of Music.*
 Clifford W. Brown, M.F.A. (Carnegie Tech), *Assistant Dean of Creative Arts Center and Professor of Music.*
 Thomas S. Brown, M.M.E. (U. Mont.), *Assistant Professor of Music. Music Education.*
 Thomas S. Canning, M.M. (Eastman Sch. Music, U. Rochester), *Professor of Music. Composition, Theory.*
 Jon E. Engberg, M.M. (Eastman Sch. Music, U. Rochester), *Assistant Professor of Music. Violoncello, Theory.*
 Clyde N. English, D.S.M. (Union Theol. Sem.), *Associate Professor of Music. Organ, Church Music.*
 Herman Godes, M.M. (Latvian St. Music Acad.), *Professor of Music. Piano.*
 Joseph A. Golz, M.A. (Columbia U.), *Associate Professor of Music and Director of Opera Department and Choral Organizations.*

- Leo Horacek, Ph.D. (U. Kans.), *Professor of Music and Chairman of Music Education.*
- Barton Hudson, Ph.D. (Ind. U.), *Assistant Professor of Music. Musicology.*
- Gerald Lefkoff, Ph.D. (Catholic U. America), *Associate Professor of Music. Theory, Viola.*
- Frank E. Lorince, Jr., Ph.D. (Eastman Sch. Music, U. Rochester), *Associate Professor of Music and Chairman of Theory and Composition.*
- James E. Miltenberger, D.M.A. (Eastman Sch. Music, U. Rochester), *Assistant Professor of Music. Piano.*
- Donald C. Portnoy, M.A. (Catholic U. of America), *Associate Professor of Music. Violin; Director of Symphony Orchestra and Summer Music Camp.*
- George E. Schafer, Ph.D. (Eastman Sch. Music, U. Rochester), *Professor of Music and Chairman of Graduate Studies; Lecturer in Music.*
- Mary E. Stringham, M.A. (WVU), *Assistant Professor of Music. Education.*
- R. Scott Stringham, Ph.D. (Cornell U.), *Assistant Professor of Music; Lecturer in Music.*

Division of Art

- George Nocito, M.F.A. (Temple U.), *Chairman and Professor of Art.*
- John D. Clarkson, M.A. (U. Pittsburgh), *Professor of Art.*
- Howard F. Collins, M.A. (Columbia U.), *Associate Professor of Art.*
- Barbara A. Drainer, Ed.D. (Columbia U.), *Associate Professor of Art.*
- Ben F. Freedman, M.A. (U. Ariz.), *Assistant Professor of Art.*
- Glenn B. Hamm, M.F.A. (Carnegie Tech), *Instructor in Art.*
- Joe F. Moss, M.A. (WVU), *Associate Professor of Art.*

Division of Drama

- Sam Boyd, Jr., M.F.A. (Carnegie Tech), *Chairman and Professor of Drama.*
- Robert B. Burrows, Ph.D. (Ohio St. U.), *Professor of Drama.*
- Joe E. Ford, M.A. (WVU), *Associate Professor of Drama.*
- Stephen H. Foreman, M.F.A. (Yale U.), *Instructor in Drama.*
- Lenette M. Hardin, M.A. (WVU), *Assistant Professor of Drama.*
- A. James Hawkins, M.A. (Sacramento St. C.), *Assistant Professor of Drama.*
- Patrick B. Murphy, M.A. (U. Wash.), *Instructor in Drama.*
- Charles D. Neel, Ph.D. (Cornell U.), *Assistant Professor of Drama.*

SCHOOL OF DENTISTRY

- William W. Merow, D.D.S. (U. Md.), *Professor and Chairman of Orthodontics.*

COLLEGE OF ENGINEERING

Aerospace Engineering

- Jerome B. Fanucci, Ph.D. (Penn. St. U.), *Chairman and Professor of Aerospace Engineering.*
- Yu Kao Hsu, Ph.D. (R.P.I.), *Assistant Professor of Aerospace Engineering.*
- John L. Loth, Ph.D. (U. Toronto), *Associate Professor of Aerospace Engineering.*
- Nathan Ness, Ph.D. (Brooklyn Poly. Inst.), *Professor of Aerospace Engineering.*
- William Squire, M.A. (U. Buffalo), *Professor of Aerospace Engineering.*

Syed Yusuff, Ph.D. (Brooklyn Poly. Inst.), *Professor of Aerospace Engineering.*
Richard E. Walters, Ph.D. (WVU), *Assistant Professor of Aerospace Engineering.*

Agricultural Engineering

Alfred D. Longhouse, Ph.D. (Cornell U.), *Chairman and Professor of Agricultural Engineering.*
Walter H. Dickerson, Jr., M.S.Ag.E. (V.P.I.), *Professor of Agricultural Engineering.*
Robert G. Diener, Ph.D. (Mich. St. U.), *Assistant Professor of Agricultural Engineering.*
Kendall C. Elliott, M.S.Ag.E. (WVU), *Assistant Professor of Agricultural Engineering.*
Roy E. Emerson, M.S. (Cornell U.), *Associate Professor of Agricultural Engineering.*
Arthur W. Selders, M.S.Ag.E. (U. Mass.), *Assistant Professor of Agricultural Engineering.*

Chemical Engineering

Howard P. Simons, Ph.D. (Ohio St. U.), *Chairman and Professor of Chemical Engineering.*
Richard C. Bailie, Ph.D. (Iowa St. U.), *Associate Professor of Chemical Engineering.*
George L. Blackshaw, Ph.D. (N.C. St.), *Associate Professor of Nuclear Engineering.*
William R. Boyle, Ph.D. (WVU), *Associate Professor of Chemical Engineering.*
Harold V. Fairbanks, M.S. (Mich. St. U.), *Professor of Metallurgical Engineering.*
Alfred F. Galli, M.S.Ch.E. (WVU), *Associate Professor of Chemical Engineering.*
Dean O. Harper, Ph.D. (U. Cincinnati), *Assistant Professor of Chemical Engineering.*
Paul R. Jones, M.Sc. (Ohio St. U.), *Professor of Ceramic Engineering.*
Walter A. Koehler, Ph.D. (U. Wisc.), *Professor Emeritus of Chemical Engineering.*
Duane G. Nichols, Ph.D. (U. Del.), *Assistant Professor of Chemical Engineering.*
Chin-yung Wen, Ph.D. (WVU), *Professor of Chemical Engineering.*

Civil Engineering

Emory L. Kemp, Ph.D. (U. Ill.), *Chairman and Professor of Civil Engineering.*
Wilfred H. Baker, M.S.C.E. (Syracuse U.), *Professor of Civil Engineering.*
Jerry C. Burchinal, M.S.C.E. (WVU), *Professor of Civil Engineering.*
Everett C. Carter, M.Eng. (U. Calif.), *Assistant Professor of Civil Engineering.*
Charles R. Jenkins, Ph.D. (Okla. St. U.), *Associate Professor of Sanitary Engineering.*
Lee E. King, Dr.Eng. (U. Calif., Berkeley), *Assistant Professor of Civil Engineering.*
Benjamin Linsky, M.S.E. (U. Mich.), *Professor of Sanitary Engineering (Air Pollution).*
Larry D. Luttrell, Ph.D. (Cornell U.), *Associate Professor of Civil Engineering.*
Lyle K. Moulton, Ph.D. (WVU), *Assistant Professor of Civil Engineering.*
Dennis H. Parr, D.Sc. (New Mex. St. U.), *Assistant Professor of Civil Engineering.*
Byron E. Ruth, Ph.D. (WVU), *Assistant Professor of Civil Engineering.*
William A. Sack, Ph.D. (Mich. St. U.), *Assistant Professor of Civil Engineering.*
James H. Schaub, Ph.D. (Purdue U.), *Associate Dean and Professor of Civil Engineering.*
Roger K. Seals, Ph.D. (N.C. St. U.), *Associate Professor of Civil Engineering.*
Eugene F. Smith, Ph.D. (U. Tex.), *Assistant Professor of Civil Engineering.*
Frederick J. Wegmann, Ph.D. (Northwestern U.), *Assistant Professor of Civil Engineering.*
William J. Wilhelm, Ph.D. (N.C. St. U.), *Assistant Professor of Civil Engineering.*
Raul Zaltzman, M.S.C.E. (U. Okla.), *Associate Professor of Civil Engineering.*

Electrical Engineering

- Edwin C. Jones, M.S.E.E. (U. Ill.), *Chairman and Professor of Electrical Engineering.*
M. Dayne Aldridge, D.Sc. (U. Va.), *Assistant Professor of Electrical Engineering.*
Edwin C. Barbe, M.S.E.E. (WVU), *Assistant Professor of Electrical Engineering.*
Patrick J. Hawkins, Ph.D. (Ohio St. U.), *Assistant Professor of Electrical Engineering.*
Marion J. Smith, M.S.E.E. (U. Colo.), *Professor of Electrical Engineering.*
Nelson S. Smith, Jr., D.Sc. (U. Pittsburgh), *Associate Professor of Electrical Engineering.*
Robert E. Swartwout, Ph.D. (U. Ill.), *Professor of Electrical Engineering.*

Industrial Engineering

- Raymond E. Shafer, M.S.I.E. (Ga. Tech), *Chairman and Professor of Industrial Engineering.*
Roger W. Berger, Ph.D. (Okla. St. U.), *Assistant Professor of Industrial Engineering.*
Samy G. Elias, Ph.D. (Okla. St. U.), *Professor of Industrial Engineering.*
Robert D. Fowler, M.S.I.E. (Ga. Tech), *Professor of Industrial Engineering.*
George M. Tomko, Jr., M.S.M.E. (U. of Wisc.), *Assistant Professor of Industrial Engineering.*

Mechanical Engineering

- Howard W. Butler, Ph.D. (Yale U.), *Chairman and Professor of Mechanical Engineering.*
Chester A. Arents, M.E. (U. Ore.), *Professor of Mechanical Engineering; Dean, College of Engineering.*
Hasin T. Gencsoy, M.S.M.E. (WVU), *Professor of Mechanical Engineering.*
David E. McKee, Ph.D. (WVU), *Assistant Professor of Mechanical Engineering.*
Desmond F. Moore, Ph.D. (Penn. St. U.), *Visiting Associate Professor of Mechanical Engineering.*
In-Meei Neou, Ph.D. (Stanford U.), *Professor of Mechanical Engineering.*
Sidney H. Schwartz, Ph.D. (U. Sou. Calif.), *Assistant Professor of Mechanical Engineering.*
Robert D. Slonneger, M.S.M.E. (U. Tex.), *Professor of Mechanical Engineering.*
Emil J. Steinhardt, Ph.D. (U. Pittsburgh), *Associate Professor of Mechanical Engineering.*

Theoretical and Applied Mechanics

- Edward F. Byars, Ph.D. (U. Ill.), *Chairman and Professor of Theoretical and Applied Mechanics.*
Sunder H. Advani, Ph.D. (Stanford U.), *Associate Professor of Theoretical and Applied Mechanics.*
Charles R. Evces, Ph.D. (WVU), *Assistant Professor of Theoretical and Applied Mechanics.*
Russell Rex Haynes, Ph.D. (WVU), *Assistant Professor of Theoretical and Applied Mechanics.*
Warren G. Lambert, Ph.D. (Iowa St. U.), *Associate Professor of Theoretical and Applied Mechanics.*
James H. McElhaney, Ph.D. (WVU), *Professor of Theoretical and Applied Mechanics.*
Helen L. Plants, M.S.C.E. (WVU), *Associate Professor of Theoretical and Applied Mechanics.*
Robert D. Snyder, Ph.D. (WVU), *Professor of Theoretical and Applied Mechanics.*

- James R. Stafford, Jr., Ph.D. (V.P.I.), *Assistant Professor of Theoretical and Applied Mechanics.*
- George W. Weaver, M.S.M.E. (WVU), *Professor of Theoretical and Applied Mechanics.*
- Donald T. Worrell, M.S.E.E. (WVU), *Professor of Theoretical and Applied Mechanics.*

SCHOOL OF MINES

- Charles T. Holland, M.S.E.M. (WVU), *Dean, School of Mines; Professor of Mining Engineering.*
- Abdel-Kader Kotb, Ph.D. (Okla. U.), *Associate Professor of Petroleum Engineering.*
- Joseph W. Leonard, M.S. (Penn. St. U.), *Associate Professor of Mining Engineering.*
- Richard W. Laird, M.S.E.M., Pet.E. (WVU), *Associate Professor of Petroleum Engineering.*
- Joseph D. McClung, M.S.E.M. (U. Pittsburgh), *Associate Professor of Mining Engineering.*
- Ernest J. Sandy, M.S.E.M. (U. Pittsburgh), *Associate Professor of Mining Engineering.*
- James A. Wasson, M.S.Pet.E. (Penn. St. U.), *Associate Professor of Petroleum Engineering.*

COLLEGE OF HUMAN RESOURCES AND EDUCATION

Division of Clinical Studies

- Oscar G. Mink, Ed.D. (Cornell U.), *Director of Clinical Studies and Associate Professor.*
- Robert J. Babcock, Ed.D. (Cornell U.), *Associate Professor and Director of Training.*
- Thomas L. Blaskovics, Ph.D. (U. Wisc.), *Associate Professor of Rehabilitation Counseling.*
- Allen Blumberg, Ed.D. (Syracuse U.), *Associate Professor of Special Education.*
- Duane Brown, Ph.D. (Purdue U.), *Associate Professor of Counseling and Guidance.*
- James S. DeLo, Ph.D. (U. Pittsburgh), *Assistant Professor of Counseling and Guidance.*
- Jonell H. Folds, Ed.D. (U. Ga.), *Associate Professor of Counseling and Guidance.*
- Michael S. Goldman, M.A. (U. Minn.), *Assistant Professor of Rehabilitation Counseling.*
- Thomas C. Hatcher, M.A. (WVU), *Assistant Professor of Reading.*
- Barbara E. James, Ph.D. (Fla. St.), *Associate Professor and Research Associate of Counseling and Guidance.*
- Eddie C. Kennedy, Ed.D. (Ind. U.), *Professor and Coordinator of Reading.*
- Glen P. McCormick, Ph.D. (Purdue U.), *Associate Professor and Coordinator of Speech Pathology—Audiology.*
- Alfred P. MacDonald, Jr., Ph.D. (Cornell U.), *Assistant Professor and Research Associate of the Regional Rehabilitation Research and Training Center.*
- Robert L. Masson, Ed.D. (U. Buffalo), *Associate Professor and Coordinator of Rehabilitation Counseling.*
- Joseph B. Moriarty, Ph.D. (Fordham U.), *Director and Assistant Professor of Regional Rehabilitation Research and Training Center.*
- Gabriel A. Nardi, Ph.D. (U. Wisc.), *Assistant Professor of Special Education.*
- Robert H. Neff, Ed.D. (WVU), *Associate Professor and Coordinator of Special Education.*

- Charles E. Smith, Ph.D. (U. Wyo.), *Associate Professor of Counseling and Guidance.*
- Manford A. Sonstegard, Ph.D. (Northwestern U.), *Professor of Counseling and Guidance.*
- David J. Srebalus, Ed.D. (Ind. U.), *Assistant Professor of Counseling and Guidance.*
- George E. Stormer, Ed.D. (U. Ill.), *Associate Professor and Coordinator of Counseling and Guidance.*
- Charles K. Stuart, Ed.D. (Colo. St. U.), *Assistant Professor of Rehabilitation Counseling.*
- Meng-Shu Tseng, Ed.D. (Ind. U.), *Associate Professor and Research Associate of the Regional Rehabilitation Research and Training Center.*
- Richard T. Walls, Ph.D. (Penn. St. U.), *Assistant Professor and Research Associate of the Regional Rehabilitation Research and Training Center.*

Division of Education

- William K. Katz, Ed.D. (U. Tex.), *Director of Division of Education and Professor of Education.*
- Benjamin H. Bailey, Ed.D. (U. Fla.), *Associate Professor of Education.*
- Sheldon R. Baker, Ed.D. (Western Reserve U.), *Assistant Professor of Education.*
- Laddie R. Bell, Ed.D. (U. Va.), *Associate Professor of Education.*
- Earl R. Boggs, Ph.D. (Geo. Peabody C.), *Professor of Education.*
- Jack H. Bond, Ed.D. (U. of Ore.), *Assistant Professor of Education.*
- Thomas J. Brennan, Ed.D. (Bradley U.), *Professor of Education.*
- Robert B. Brumbaugh, Ed.D. (Penn. St. U.), *Associate Professor of Education.*
- R. C. Butler, Ph.D. (Cornell U.), *Professor of Education and Agricultural Education.*
- John L. Carline, Ph.D. (Syracuse U.), *Assistant Professor of Education.*
- Wincie Ann Carruth, Ph.D. (N.Y.U.), *Professor of Education and Physical Education.*
- Glennis H. Cunningham, M.A. (WVU), *Instructor in Education.*
- Paul W. DeVore, Ed.D. (Penn. St. U.), *Professor of Education.*
- Richard C. Franklin, Ed.D. (Columbia U.), *Professor of Education and Sociology.*
- Wilson I. Gautier, Ed.D. (WVU), *Associate Professor of Education.*
- Keith E. Glancy, Ph.D. (Purdue U.), *Associate Professor of Education.*
- Harold I. Goodwin, Ph.D. (U. Calif.), *Associate Professor of Education.*
- Harry B. Heflin, Ph.D. (U. Pittsburgh), *Professor of Education.*
- Arthur N. Hofstetter, Ed.D. (U. of Va.), *Chairman of Educational Administration and Professor of Education.*
- Boyd Holtan, Ed.D. (U. Ill.), *Associate Professor of Education.*
- Frederick J. Holter, Ph.D. (N.Y.U.), *Professor of Education and Physical Education.*
- Leo Horacek, Ph.D. (U. Kans.), *Associate Professor of Education and Music.*
- Stanley O. Ikenberry, Ph.D. (Mich. St. U.), *Dean of College of Human Resources and Education and Associate Professor of Education.*
- Claude Kelley, Ed.D. (Ind. U.), *Professor of Education.*
- Warren G. Kelly, Ed.D. (U. Mo.), *Assistant Professor of Education and Assistant Professor of Agricultural Education.*
- Marvin R. Lee, M.A. (WVU), *Administrative Assistant and Instructor in Education.*
- Rogers McAvoy, Ed.D. (Ind. U.), *Chairman of Educational Psychology and Measurement and Assistant Professor of Education.*
- Delmas F. Miller, Ph.D. (U. Pittsburgh), *Chairman of Secondary Education and Professor of Education.*
- C. Kenneth Murray, Ph.D. (Ohio St. U.), *Assistant Professor of Education.*
- Richard L. Ober, Ph.D. (Ohio St. U.), *Associate Professor and Chairman, Curriculum and Instruction.*

Franklin Parker, Ed.D. (Geo. Peabody C.), *Benedum Professor of Education*.
 John J. Paterson, Ph.D. (Mich. St. U.), *Associate Professor of Education and Research Coordinator*.
 David Puzzuoli, Ed.D. (WVU), *Assistant Professor of Education*.
 John Semon, M.S. (WVU), *Associate Professor of Education and Physical Education*.
 Gerard O. Solomon, Ed.D. (U. Fla.), *Assistant Professor of Education*.
 Meng-Shu Tseng, Ed.D. (Ind. U.), *Associate Professor of Education*.
 Roman J. Verhaalen, Ph.D. (U. Wyo.), *Professor of Education*.
 Richard T. Walls, Ph.D. (Penn. St. U.), *Assistant Professor of Education*.
 Samuel E. Wood, Ed.D. (U. Fla.), *Assistant Professor of Education*.
 Mary Yeazell, Ed.D. (U. Ill.), *Assistant Professor of Education*.
 C. Peter Yost, Ph.D. (U. Pittsburgh), *Professor of Education and Dean and Professor of Physical Education*.

Division of Family Resources

William H. Marshall, Ed.D. (Columbia U.), *Director of Division of Family Resources and Professor of Child Development*.
 Gladys Raber Ayersman, M.S. (WVU), *Assistant Professor of Child Development*.
 Babette Graf, M.S. (Penn. St. U.), *Associate Professor of Nutrition*.
 Frank H. Hooper, Ph.D. (Wayne St. U.), *Assistant Professor of Child Development and Assistant Professor of Psychology*.
 Ruth P. Hughes, Ph.D. (Cornell U.), *Associate Professor of Home Economics Education*.
 Mary Rose Jones, M.S. (WVU), *Associate Professor of Home Economics*.
 Betty Lou Ramsey, M.S. (U. Tenn.), *Assistant Professor of Housing and Design*.
 John A. Shultz, Ph.D. (Ohio St. U.), *Associate Professor of Family Relations*.
 Carl B. Taylor, Ph.D. (Penn. St. U.), *Associate Professor of Family Relations*.
 Ruth E. Weibel, M.S. (U. Tenn.), *Assistant Professor of Textiles and Clothing*.
 Clara M. Wendt, M.S. (Cornell U.), *Assistant Professor of Family Economics*.
 Margaret A. Wilson, Ph.D. (Ohio St. U.), *Professor of Nutrition*.

Division of Social Work

Leon H. Ginsberg, Ph.D. (U. Okla.), *Director and Professor of Social Work*.
 Janet Ades, M.S.W. (N.Y.U.), *Assistant Professor of Social Work*.
 Roman Aquizap, M.A. (U. New Hamp.), *Visiting Assistant Professor of Social Work*.
 Betty L. Baer, M.S.S. (Syracuse U.), *Assistant Professor of Social Work*.
 Anna E. Blackwell, A.M. (U. Chicago), *Assistant Professor of Social Work*.
 Stanley Blostein, M.S.S.W. (U. Louisville), *Assistant Professor of Social Work*.
 Marjorie Buckholz, Ph.D. (N.Y.U.), *Professor of Social Work*.
 Charlotte Diehl, M.S.W. (WVU), *Assistant Professor of Social Work*.
 C. Courtney Elliott, M.S.W. (Tulane U.), *Assistant Professor of Social Work*.
 Helen S. Ellison, M.S.W. (Columbia U.), *Associate Professor of Social Work*.
 Harvey L. Gochros, D.S.W. (Columbia U.), *Professor of Social Work and Director of Branch Programs*.
 John F. Isaacson, M.S.W. (U. Penn.), *Assistant Professor of Social Work*.
 Caroline T. Mudd, M.S.W. (U. Penn.), *Associate Professor of Social Work*.
 Ralph Rogers, M.S.W. (U. Okla.), *Instructor in Social Work*.
 LeRoy G. Schultz, M.S.W. (Wash. U.), *Assistant Professor of Social Work*.
 Josephine H. Stewart, M.S.W. (U. of Pittsburgh), *Assistant Professor of Social Work*.
 David Williams, M.S.W. (U. Calif., Berkeley), *Assistant Professor of Social Work*.

Faculty of Human Resources Research Institute

- Ernest A. Vargas, M.A. (Columbia U.), *Acting Director and Assistant Professor of Sociology.*
- Roman B. Aquizap, M.A. (U. New Hampshire), *Research Associate and Assistant Professor of Social Work.*
- Richard A. Ball, Ph.D. (Ohio St. U.), *Research Associate and Associate Professor of Sociology.*
- Robert Brumbaugh, Ed.D. (Penn. St. U.), *Research Associate and Associate Professor for Research in Educational Administration.*
- Harold Goodwin, Ph.D. (U. Calif.), *Research Associate and Visiting Associate Professor of Educational Administration.*
- Larry R. Goulet, Ph.D. (St. Louis U.), *Research Associate and Assistant Professor of Psychology.*
- Frank H. Hooper, Ph.D. (Wayne U.), *Research Associate and Assistant Professor of Child Development and Psychology.*
- Barbara E. James, Ph.D. (Fla. St. U.), *Research Associate and Visiting Associate Professor of Clinical Studies.*
- John Nesselroade, Ph.D. (U. Ill.), *Research Associate and Assistant Professor of Psychology.*
- K. Warner Schaie, Ph.D. (U. Wash.), *Research Associate, Human Resources Research Institute and Professor of Psychology.*

SCHOOL OF JOURNALISM

- Quintus C. Wilson, Ph.D. (U. Minn.), *Dean, School of Journalism; Professor of Journalism.*
- Gerald W. Ash, M.S.J. (WVU), *Assistant Professor of Journalism.*
- Paul A. Atkins, M.A. (U. Va.), *Associate Professor of Journalism.*
- Francis L. Blake, M.S.J. (WVU), *Assistant Professor of Journalism.*
- Donovan H. Bond, M.A. (WVU), *Professor of Journalism.*
- Harry W. Ernst, M.S.J. (Northwestern U.), *Assistant Professor of Journalism.*
- Richard L. Hopkins, M.S.J. (WVU), *Assistant Professor of Journalism.*
- Hunter P. McCartney, Ph.D. (U. Penn.), *Professor of Journalism.*
- James R. Redmond, M.S.J. (WVU), *Lecturer in Journalism.*
- Guy H. Stewart, Ph.D. (U. Ill.), *Professor of Journalism.*
- Donald D. Stillman, M.S. (Columbia U.), *Assistant Professor of Journalism.*
- William R. Summers, Jr., M.A. (U. Mo.), *Professor of Journalism.*
- C. Gregory Van Camp, M.S.J. (WVU), *Assistant Professor of Journalism.*
- Wayne R. Whitaker, M.S.J. (U. Ore.), *Assistant Professor of Journalism.*
- David A. Wiley, M.S.J. (WVU), *Assistant Professor of Journalism.*
- Paul G. Yeazell, M.A. (U. Ariz.), *Assistant Professor of Journalism.*

SCHOOL OF MEDICINE

Anatomy

- Donald L. Kimmel, Ph.D. (U. Mich.), *Chairman and Professor.*
- Paul E. Benoit, Ph.D. (U. Mo.), *Assistant Professor.*
- William A. Beresford, D.Phil. (Oxford U.), *Assistant Professor.*
- James L. Culbertson, Ph.D. (Tulane U.), *Assistant Professor.*
- A. Curtis Higginbotham, Ph.D. (Northwestern U.), *Professor.*

Frances H. Higginbotham, Ph.D. (WVU), *Assistant Professor*.
David S. Jones, Ph.D. (Loyola U.), *Professor*.
Robert E. McCafferty, Ph.D. (U. Pittsburgh), *Associate Professor*.
Carlin A. Pinkstaff, Ph.D. (Emory U.), *Assistant Professor*.
Randall W. Reyer, Ph.D. (Yale U.), *Professor*.
T. Walley Williams, Ph.D. (U. Pittsburgh), *Professor*.

Biochemistry

Reginald F. Krause, M.D. (U. Vt.), Ph.D. (U. Rochester), *Chairman and Professor*.
William J. Canady, Ph.D. (Geo. Washington U.), *Professor*.
James B. Gilbert, M.D. (Jefferson Med. C.), *Assistant Professor*.
Sam Katz, Ph.D. (Northwestern U.), *Associate Professor*.
Frederick J. Lotspeich, Ph.D. (Purdue U.), *Professor*.
Gale W. Rafter, Ph.D. (U. Wash.), *Associate Professor*.
Harold Resnick, Ph.D. (U. Iowa), *Associate Professor*.
George P. Tryfiates, Ph.D. (Rutgers U.), *Assistant Professor*.
George H. Wirtz, Ph.D. (Geo. Washington U.), *Associate Professor*.

Microbiology

John M. Slack, Ph.D. (U. Minn.), *Chairman and Professor*.
Robert G. Burrell, Ph.D. (Ohio St. U.), *Professor*.
Samuel J. Deal, Ph.D. (U. Minn.), *Associate Professor*.
Vincent F. Gerencser, Ph.D. (U. Ky.), *Associate Professor*.
John E. Hall, Ph.D. (Purdue U.), *Associate Professor*.
Billy E. Kirk, Ph.D. (Ohio St. U.), *Assistant Professor*.
Henry F. Mengoli, Ph.D. (Catholic U.), *Assistant Professor*.
Robert S. Pore, Ph.D. (U. Calif.), *Assistant Professor*.
Herbert G. Voelz, Ph.D. (St. U. Greifswald, Germany), *Associate Professor*.

Pathology

Wilhelm S. Albrink, M.D. (Yale U.), *Professor and Chairman of Pathology*.
Vicente Anido, M.D. (U. Havana), *Director of Clinical Laboratories and Professor of Pathology*.
C. Richard Chamberlain, Jr., M.D. (U. Va.), *Associate Professor of Pathology*.
Enid F. Gilbert, M.D. (U. Sidney, Australia), *Associate Professor of Pathology*.

Pharmacology

William W. Fleming, Jr., Ph.D. (Princeton U.), *Professor and Chairman*.
Richard J. Cenedella, Ph.D. (Jefferson Med. C.), *Assistant Professor*.
Charles R. Craig, Ph.D. (U. Wisc.), *Assistant Professor*.
Joseph J. McPhillips, Ph.D. (Jefferson Med. C.), *Assistant Professor*.
Robert L. Robinson, Ph.D. (U. Kans.), *Associate Professor*.
Leroy H. Saxe, Jr., Ph.D. (U. Penn.), *Professor*.
Robert E. Stitzel, Ph.D. (U. Minn.), *Associate Professor*.
John A. Thomas, Ph.D. (St. U. Iowa), *Associate Professor*.
Knox Van Dyke, Ph.D. (St. Louis U.), *Senior Research Pharmacologist*.

Physiology and Biophysics

- Michael F. Wilson, M.D. (U. Penn.), *Chairman and Professor.*
Gunter N. Franz, Ph.D. (U. Wash.), *Assistant Professor.*
Ludwig Gutmann, M.D. (Columbia U.), *Associate Professor.*
Wilbert E. Gladfelter, Ph.D. (U. Penn.), *Associate Professor.*
Ping Lee, Ph.D. (Duke U.), *Assistant Professor.*
Hugh A. Lindsay, Ph.D. (U. Toronto), *Associate Professor.*
Robert J. Marshall, M.D. (Queens U., N. Ireland), *Professor.*
Walter H. Moran, Jr., M.D. (Harvard U.), *Associate Professor.*
Thomas W. McIntyre, Ph.D. (U.C.L.A.), *Assistant Professor.*
David W. Northup, Ph.D. (U. Ill.), *Professor.*
John C. Stickney, Ph.D. (U. Minn.), *Professor.*
Edward J. Van Liere, Ph.D. (U. Chicago), *Professor Emeritus.*
Kenneth C. Weber, Ph.D. (U. Minn.), *Assistant Professor.*

SCHOOL OF PHARMACY

- Raphael O. Bachmann, Ph.D. (Purdue U.), *Dean of School of Pharmacy and Professor of Pharmaceutical Chemistry.*
Alfred C. Core, Ph.D. (U. Ill.), *Associate Professor of Pharmaceutical Chemistry.*
James Khai-Jin Lim, Ph.D. (U. N.C.), *Assistant Professor of Pharmaceutics.*
Frank D. O'Connell, Ph.D. (Purdue U.), *Professor of Pharmacognosy.*
James Parker, Ph.D. (Purdue U.), *Assistant Professor of Pharmaceutics.*
Robert Eugene Roehrs, Ph.D. (Purdue U.), *Assistant Professor of Pharmacy.*
Albert F. Wojcik, Ph.D. (U. Pittsburgh), *Associate Professor of Pharmacy Administration.*
Paul Zanowiak, Ph.D. (U. Fla.), *Associate Professor of Pharmaceutics.*

SCHOOL OF PHYSICAL EDUCATION

- C. Peter Yost, Ph.D. (U. Pittsburgh), *Dean, School of Physical Education; Professor of Physical Education.*
Wincie Ann Carruth, Ph.D. (N.Y.U.), *Chairman of Women's Physical Education; Professor of Physical Education.*
John Semon, M.S. (WVU), *Chairman of Department of Physical Education for Men; Associate Professor of Physical Education.*
Thomas J. Sheehan, Ph.D. (Ohio St. U.), *Associate Professor of Physical Education.*
Patrick A. Tork, M.S. (WVU), *Professor of Physical Education.*

INDEX

A

Abbreviations 39
Academic information
 and regulations 23
Accounting 108
Accreditation, WVU 8
Administrative officers 5
Admissions 24
Advanced study certificate 30, 166
Adviser (for students) 25
AEC fellowships 20
Aerospace engineering 126
Agricultural engineering 129
 Forest engineering 130
AGRICULTURE 39, 18, 230
 Agronomy and genetics 45
 Animal industry and
 veterinary science 47
 Bacteriology 51
 Biochemistry 40
 Economics 41
 Education 43
 Engineering 129
 Forest engineering 130
 Forestry 52
 Horticulture 49
 Mechanics 44
 Plant pathology and
 bacteriology 51
 Recreation 55
Agronomy and genetics 45
Anatomy 214
Animal industry and
 veterinary science 47
Appalachian center 20
ART 121, 242
ARTS AND SCIENCES 56, 233
 Astronomy 83
 Biology 56
 Botany 56
 Chemistry 59
 Economics 62, 105
 English 62
 Foreign languages 66
 Geology and geography 71
 History 74
 Latin American area studies 70
 Library science 77
 Mathematics 78
 Philosophy 85
 Physics 87
 Political science 88

Psychology 94
Religious studies 99
Sociology 100
Speech 102
Statistics 79

Assistantships, fellowships,
 and traineeships 17
Astronomy 83
Auditing (courses) 36

B

Bacteriology, agricultural 51
Basic sciences, Medical Center 213
Biochemistry, agricultural 40;
 medical 215
BIOLOGICAL SCIENCES,
 Institute of 207, 239
 Agriculture 207
 Botany and zoology 207
 Interdepartmental programs 209
 Medicine 208
 Teaching assistantships 17
Biology 56
Biophysics 217
Board of governors 2, 11
Book stores 16
Botany 56
Business administration 105

C

Calendar, WVU 4
Candidacy for degrees 26
Certificates, graduate 30
Chemical engineering 131
Chemistry 59
Child development 197
Civil engineering 135
CLINICAL STUDIES 165
 Counseling and guidance 167
 Reading 174
 Rehabilitation counseling 176
 Special education 178
 Speech pathology and
 audiology 179
Commencement attendance 28
COMMERCE 105, 19, 240
 Accounting 108
 Economics 106, 108
 Finance 111
 Management 111
 Marketing 111

Committees, WVU 7
Computer center 15
Conduct, student 23
Counseling and guidance 167
Counseling service, student 13
Courses 39

CREATIVE ARTS CENTER 112,
94, 241
Art 121
Drama 122
Music 112, 34

Credit, WVU 26
Cultural activities 17

D

Daily Athenaeum fee 34
Dance 226
Danforth fellowships 20
Degrees, graduate 28

DENTISTRY 219, 242

Dissertations 27, 32
Doctor of education 33
Doctor of musical arts 33
Doctor of philosophy 30

DRAMA 122, 242

E

Economics 106, 108;
agricultural 41

EDUCATION 162

Electrical engineering 142
Employed graduate students 27

ENGINEERING 124, 19, 242

Aerospace 126
Agricultural 129
Chemical 131
Materials science 132
Nuclear 132
Civil 135
Electrical 142
Forest 130
Industrial 146
Mechanical 152
Mining 158
Theoretical and applied
mechanics 155

English 62
Enrollment, WVU 8
Entomology 51
Examinations 25
Executive committee, graduate
school 7, 23
Extension 26, 34

F

Faculty, graduate 231
Family: economics 198;
relations 197

FAMILY RESOURCES 196, 247

FEES AND EXPENSES 34

Fellowships, assistantships,
traineeships 17
Final examinations 28
Finance 111
Financial aids, student 17
Financial structure, WVU 12
Foods 191

Foreign languages 66

French 66
German 68
Greek 69
Latin 68
Latin American area studies 70
Russian 68
Spanish 67

Foreign students 14, 25

Forest engineering 130

FORESTRY 56, 18, 231

French 66

Full-time student 35, 36 (footnote 6)

G

General regulations 23
Genetics 45
Geology and geography 71
German 68
Government of WVU 11
Graduate record examination 25
Grants 17
Greek 69

H

HEA fellowships 20
Health education 194
Health Service 13
High School, University 182
History 74
History, WVU 8
Home economics 196
Home management 198
Horticulture 49
Housing, student 11
Housing and design 197

HUMAN RESOURCES
AND EDUCATION 162, 245

Clinical studies 165
Education 182
Family resources 196

Human resources research
institute 165
Social work 199

I, J, K

Industrial arts 187
Industrial engineering 146
Industrial relations 206
Infirmary, WVU 13
Information, WVU 16, 23

INSTITUTE OF BIOLOGICAL
SCIENCES 19, 207, 239

Insurance, student 13

JOURNALISM 210, 19, 248

KANAWHA VALLEY GRADUATE
CENTER 10

Kent fellowships 20

L

Landscape architecture 50
Languages, foreign 66
Latin 68
Latin American area studies 70
Library science 77
Library, WVU 15
Linguistics 69
Literature 62
Living accommodations 11

M

Management 111
Marketing 111
Master of arts 28
Master of science 28
Materials science engineering 132
Mathematics 78
Mechanical engineering 152
MEDICAL CENTER 213, 19, 248
 Anatomy 214
 Biochemistry 215
 Biophysics 217
 Dentistry 219
 Medical technology 194
 Medicine 216
 Microbiology 216
 Pathology 217
 Pharmaceutical chemistry 221
 Pharmacognosy 221
 Pharmacology 217
 Pharmacy 220
 Physiology and biophysics 217
Medical technology 194
Medicine 216
Microbiology 216
MINES 158, 245

Morgantown 8
Mountainlair 16, 34
MUSIC 112, 34, 241

N

NASA traineeships 17
NDEA Title IV fellowships 20
NSF fellowships 20;
 traineeships 20
Nuclear engineering 132

O

Oak Ridge fellowships 20
Orthodontics 219

P

Parking, campus auto 16
Pathology 217
Petroleum engineering 160

PHARMACY 220, 250

Pharmaceutical chemistry 221
Pharmacology 217
Philosophy 85
Philosophy, doctor of 30

PHYSICAL EDUCATION 223,
 19, 250
 Dance 226
 Physical education 227
 Safety education 229

Physical plant, WVU 9
Physics 87
Physiology and biophysics 217
Placement service, WVU 16
Plant pathology and bacteriology 51
Plant physiology 209
Political science 88
Problem reports 27
Psychology 94
Public Health Service fellowships 20

R

Reading 174
Recreation 52, 55
Refunding of fees 37
Regional research institute 19
Registration 26
Rehabilitation counseling 176
Religious studies 99
Remission of fees 36
Reproductive physiology 209
Request for degree 28
Requirements for degrees 28
Research grants 22
Russian 65

S

Safety education 228, 19
Scholarship 27
Seniors doing graduate work 25

SOCIAL WORK 199, 247

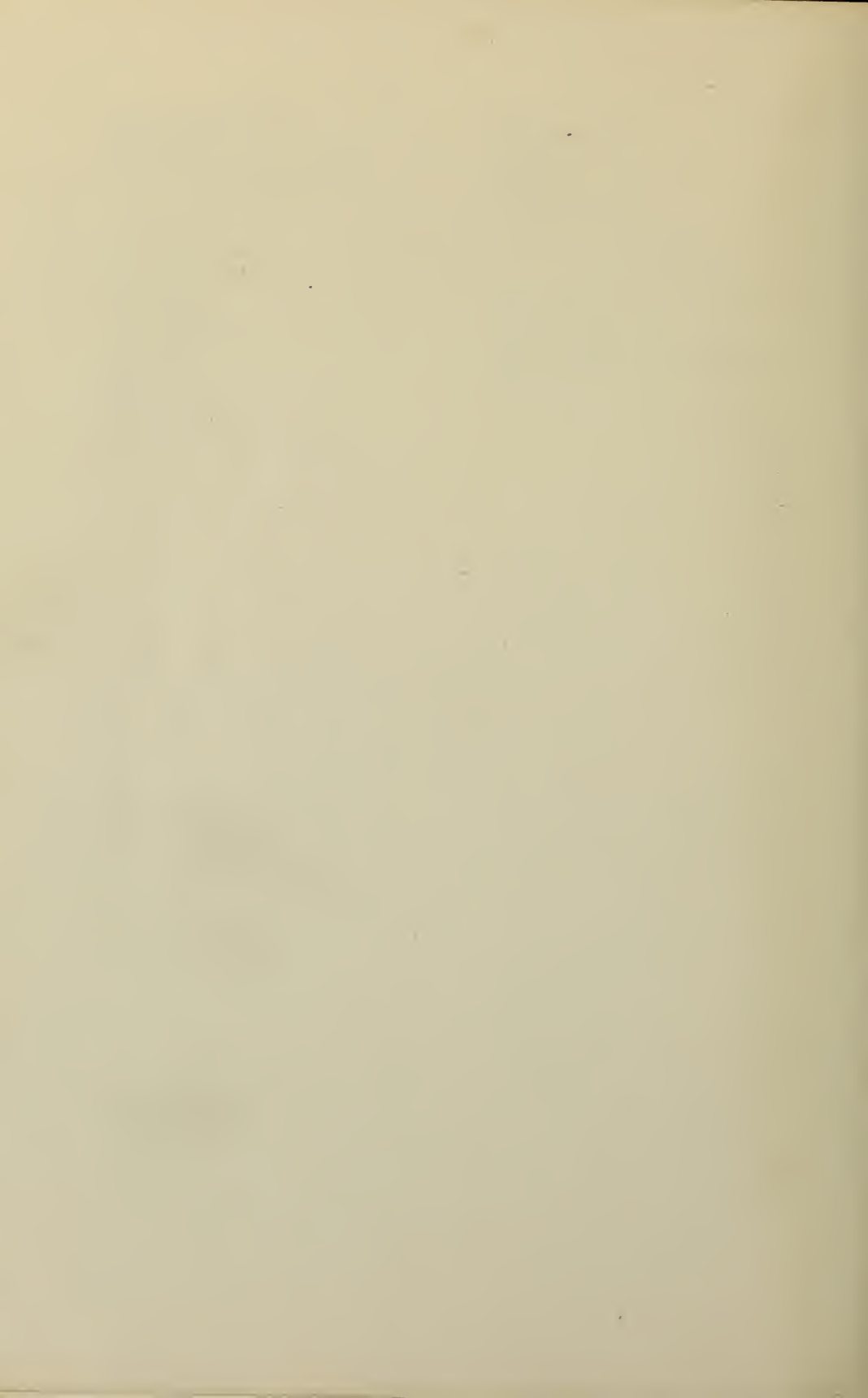
Sociology 100
Spanish 67
Special education 178
Special fees 34
Speech 102
Speech pathology
 and audiology 179
Statistics 79
Stipend payment dates 22
Student counseling service 13
Student union 16, 34
Summer session 18; fees 36

T

Teaching grants 22
Theoretical and
 applied mechanics 155
Theses 27
Traineeships 17
Transfer credit 26

U, V, W, Z

U. S. Steel geology fellowship 21
Veterans 14
Veterinary science 47
Woodrow Wilson fellowship 22
WVU Foundation fellowships 20, 22
Zoology 57



BEQUESTS FOR WEST VIRGINIA UNIVERSITY

SUGGESTED FORMS

Inquiries concerning bequests or other gifts to The Board of Governors of West Virginia University, or to The West Virginia University Foundation, Incorporated, should be addressed to the Office of the President, West Virginia University, Administration Building, Morgantown, West Virginia 26506.

The following are suggested as appropriate forms for bequests to West Virginia University Foundation, Incorporated:

General

I give to THE WEST VIRGINIA UNIVERSITY FOUNDATION, INCORPORATED, a non-profit corporation existing under the laws of the State of West Virginia, for the sole purpose of serving West Virginia University, the sum of _____ Dollars to be used solely for educational purposes of The University.

Stated Purpose

I give to THE WEST VIRGINIA UNIVERSITY FOUNDATION, INCORPORATED, a non-profit corporation existing under the laws of the State of West Virginia, the sum of _____ Dollars and direct that the income therefrom shall be used for the following purpose or purposes:

(Here specify in detail the purpose or purposes).

The following are suggested as appropriate forms for bequests to West Virginia University:

General

I give to WEST VIRGINIA UNIVERSITY, acting through the Board of Governors of West Virginia University, a statutory corporation of the State of West Virginia the sum of _____ Dollars to be used for educational purposes only of The University.

Stated Purpose

I give to WEST VIRGINIA UNIVERSITY, acting through the Board of Governors of West Virginia University, a statutory corporation of the State of West Virginia the sum of _____ Dollars and direct that the income therefrom shall be used for the following purposes:

(Here specify in detail the purpose or purposes).

If such restricted purpose is adequately served, some other or similar purpose, then inadequately funded, may be the recipient of such income.

